# MACHINERY

## *Design—Construction—Operation*

**Volume 40** **JUNE, 1934** **Number 10**

***Sound Engineering Knows How to Balance Cost with Expected Results*** **— This basic principle is the keynote of the leading article in July MACHINERY, which describes the modernizing of equipment and methods in an eastern quantity-production plant. Developments in Brass Die-casting Methods, the Control of Industrial Processes by the Electric Eye, and Recent Practice in Motor Drives, are some of the other subjects covered in the July number.**

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# IMPORTANT TO EXECUTIVES

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The LODGE &

MACHINERY

Volume 40 NEW YORK, JUNE, 1934 Number 10

# *Research—The Cornerstone of Industry*

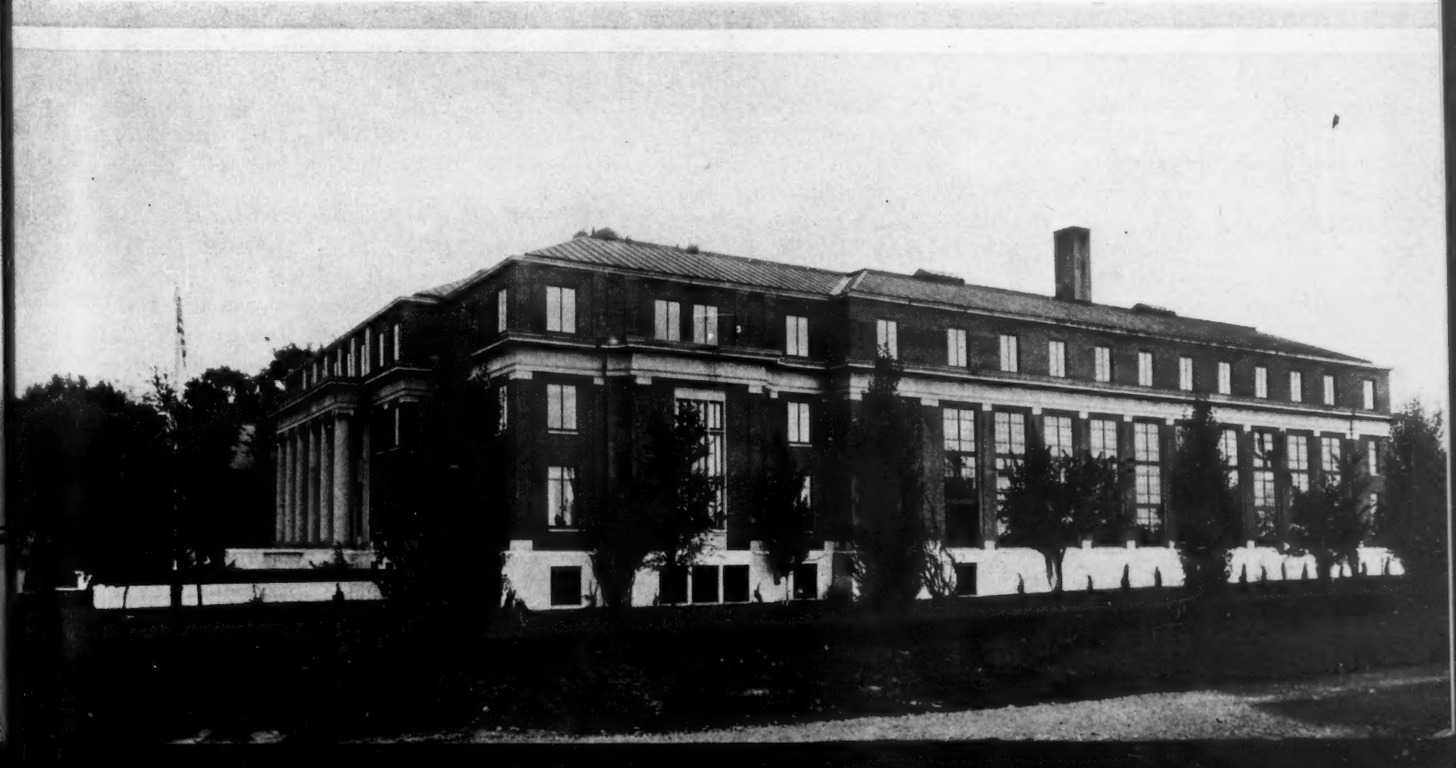
## *A Scientific Laboratory that Makes Available to Industry Facilities for Carrying on Exhaustive Research*

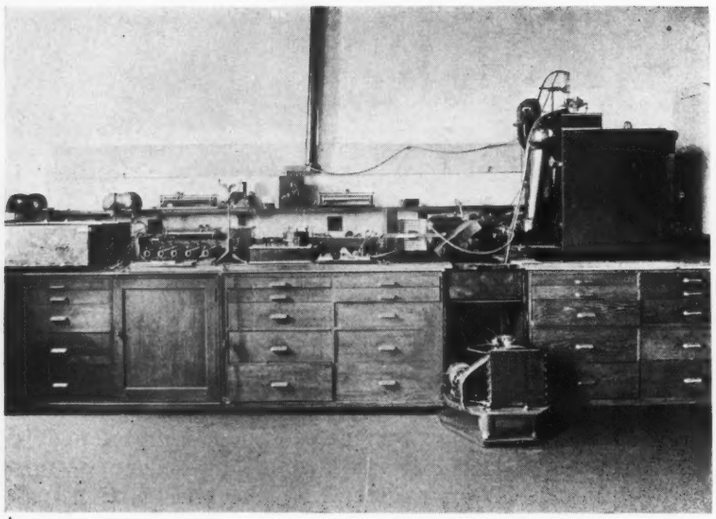
*By CHARLES O. HERB*

INDUSTRIAL progress depends upon the solution of problems that constantly arise from ever-changing conditions. These problems may relate to the development of new materials or products, or to the improvement of products or methods of manufacture. It was through an attempt to meet new needs of industry that phenolic plastics, tungsten and tantalum carbides, alloy steels, high-strength bronzes, and a host of other materials were developed.

Research is the foundation on which industry must build for a satisfactory solution of many of its problems. The development of new materials and the finding of new applications for old involves exhaustive study and systematic experimentation. This fact is recognized by such large industrial concerns as the General Electric Co., the Westinghouse Electric & Mfg. Co., the Aluminum Co. of America, General Motors Co., the Republic Steel Corporation, the New Jersey Zinc Co., the International Nickel Co., the U. S. Steel Corporation, and others that maintain extensive metallurgical, chemical, and physical laboratories devoted to applied scientific research.

Scientific laboratories for extensive research would be far too expensive to maintain in the average industrial plant. Many metal-working plants have laboratories for checking the physical properties and analyses of the raw materials and of the finished products; but as these are essentially pro-





*Equipment Used in Studying the Heat Conductivity of Metals and of Insulating Materials*

duction-control laboratories, problems frequently arise that are beyond the scope of their equipment and personnel. Where to find facilities for the extensive research required in such cases is often a question.

The Battelle Memorial Institute, Columbus, Ohio, provides just such facilities. It was established to carry out scientific research in metallurgy, fuels, and allied subjects, through the vision of the son of an industrial leader who had made his fortune in the coal and iron industries. The will of the son generously endowed the Institute, and this endowment was later augmented by a bequest of his mother. The family name has thus been commemorated by a benefaction to industry and humanity.

### *The Origin of Modern Industries is Research*

A visitor to this institute of service to industry is struck by the impressive Ionic entrance, the marble lobby, and the paneled library, but the glory of the Institute lies in the practical service that it renders rather than in the grandeur of the edifice in which it is housed. The entire staff consists of about seventy persons, including the scientific staff of forty-five persons, the shop workers, and the clerical employes.

The members of the scientific staff hold degrees from twenty-one different colleges and universities, including ten doctors' degrees. Many have had long experience in research organizations, commercial plants, governmental, university, and other laboratories. The chief technical adviser, Dr. H. W. Gillett, was formerly chief metallurgist of the United States Bureau of Standards, and before that was chief alloy chemist of the Bureau of Mines. The average length of time that the members of the scientific staff have been out of college is ten years. Each person was selected because of special training and interest in the fields of metals or fuels.

The equipment of the laboratory is thoroughly modern. The general chemical laboratory is well equipped for making analyses of metals and fuels. Smaller private research laboratories are fitted out for the solution of individual problems. There is a physical laboratory with equipment for electric, thermal, pyrometric, X-ray, strength, and other investigations. Theories are proved or disproved in the foundry, the machine shop, the forging shop, the heat-treating department, etc., where conditions existing in industry can be duplicated. Other equipment has been installed for studying methods for the washing of coal, the beneficiation of ores, the combustion of fuel, metallurgical problems, and ceramic studies, with special attention to refractories and enameling. Some of the equipment, particularly that for combustion and for the ore and coal purification studies, is on a decidedly large scale.

A scientific library is an important adjunct to any research organization. Unless the searcher after facts has ready access to the literature available on the subjects to be investigated, he is likely to waste a great deal of time and money in going over ground previously covered by others. The library at Battelle has more than 4200 volumes, most of them dealing with fuels, metallurgy, and allied subjects. It maintains an index of articles on these subjects that have appeared during the last few years in technical journals, both domestic and foreign. In most cases, abstracts of the articles appear on the index cards themselves. There are more than 180,000 cards in this file.

### *All Activities are Conducted on a Non-Profit-Making Basis*

Three kinds of activities are conducted by the Institute: (1) Research projects that are selected and sponsored by the Institute itself to meet a specific need of industry, as for example, more definite knowledge concerning the combustion of pulverized fuels; (2) projects in which the Institute cooperates with engineering societies, industrial concerns, or individuals, as in the study of iron alloys, a part of the expense of which is assumed by the Institute;

(3) projects sponsored by industrial concerns, the expenses of which are borne by the concerns who are having the investigation made.

The founder of the Institute wished it to be conducted on a non-profit-making basis, so that the personnel might perform their activities with scientific detachment. The generous endowment enables his wish to be carried out. Whenever the Institute conducts a research for an industrial concern, that concern pays the entire expenses of the investigation, and no more.

When a research problem is presented by a manufacturer, the Institute staff makes a preliminary survey to determine whether or not the problem and the conditions of cooperation are such as to give hope of reasonable success. It exercises the right to reject any project that conflicts with those that are under way. When a problem is finally laid out, a research engineer is selected jointly by the sponsor and the Institute to assume personal charge of the work. The activities are kept absolutely confidential, if that is the wish of the sponsor, and all patent rights derived from a research belong to the sponsor.

### *The Life of Science is its Practical Application*

In discussing the activities of the Battelle Memorial Institute, the projects financed by the Institute will be considered first. Extensive studies were made on the effects of low temperatures on the metals used for aircraft construction. Apparatus had to be built for conducting these tests at a temperature of 40 degrees F. below zero.

An elaborate investigation was made with a view to simplifying metallurgical analyses. Considerable research has been carried on to determine the mechanical or creep properties of molybdenum cast iron and other alloy cast irons. Much work has been done in investigating the fundamental principles involved in the combustion of pulverized coal. Another important research was the determination of the hardness of high-speed steels and related alloys at temperatures ranging up to 1470 degrees F.

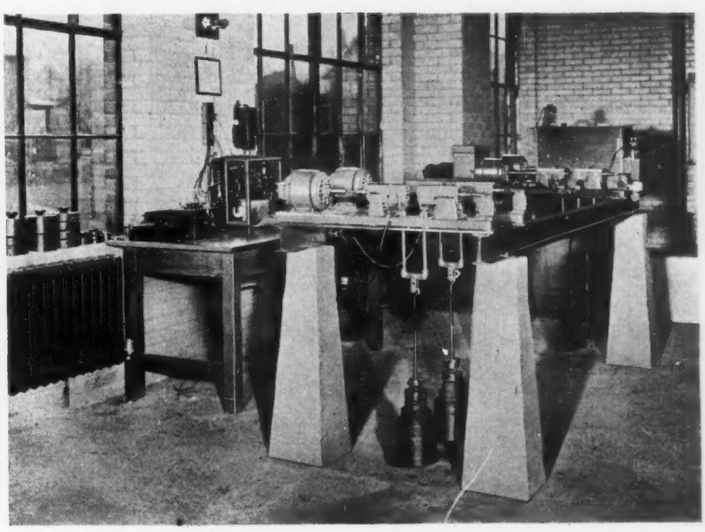
The aging of steel, the embrittlement of malleable iron in hot galvanizing, nitriding, and the vacuum melting of metals are a few of the projects that have been sponsored by the Institute for the general welfare of industry.

### *Science is Organized Knowledge*

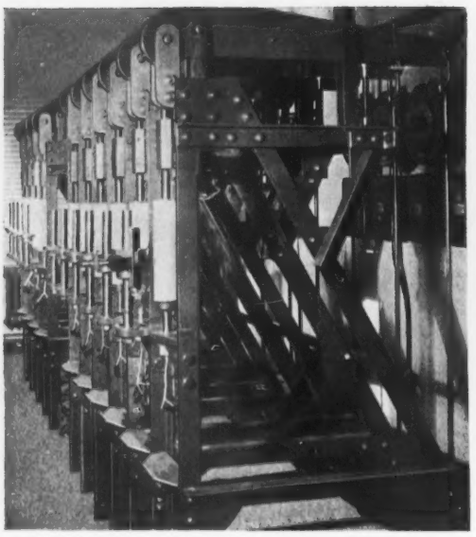
Several years ago the Engineering Foundation (the joint research body of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, and the American Society of Civil Engineers) began the preparation of a series of monographs and manuals on the alloys of iron. The Battelle Memorial Institute is cooperating in this valuable work by contributing in service an amount equal to one-third the amount of the total program. It is preparing the monographs on alloys of iron-molybdenum, iron-tungsten, iron-copper, and iron-carbon. Similar work on other iron alloys is being carried out at Lehigh University, the Carnegie Institute of Technology, and the United States Bureau of Standards.

These monographs are intended to bring into usable form all the information that has been printed on the alloys mentioned. Some idea of the magnitude of these projects may be had from the fact that information concerning the alloys of iron is scattered through about two thousand technical journals, published in ten different languages. The work undertaken at the Institute has been three-quarters completed.

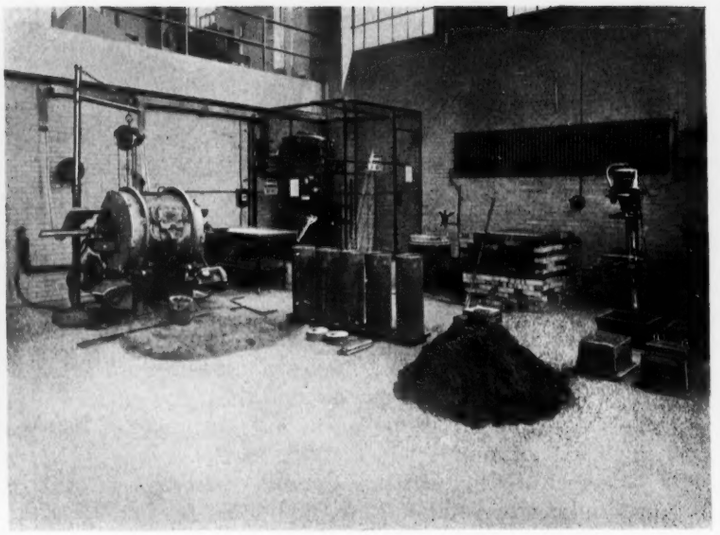
The low-temperature carbonization of coal was investigated in conjunction with Ohio State University. Boiler refractories were studied in cooperation with the American Society of Mechanical Engineers. The art of making a good speculum metal is being investigated jointly with the American Physical Society.



***Endurance Testing Equipment; the Machine in the Background Operates at a Temperature of 40 Degrees F. below Zero***

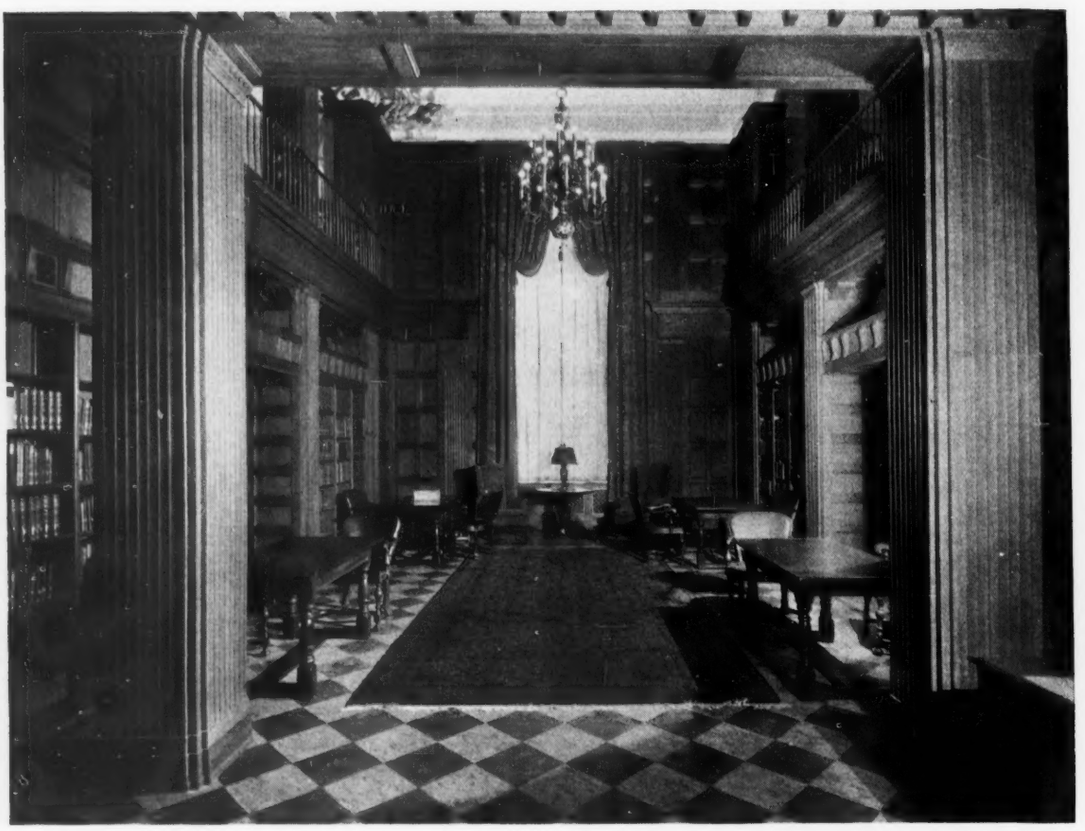


*Equipment for Determining Creep or Flow of Metals at High Temperatures*



*Electric Furnace Irons of Different Analyses are Produced in this Laboratory*

*The First Step in Research Should be to Consult the Available Technical Literature. The Battelle Library is a Storehouse of Information on Metals and Fuels*



### *The Aim of Research is Advancement*

The projects completed for industrial concerns are too numerous to list. An extensive investigation was conducted to determine the properties of bearing metals now in use and to develop a bearing material that would be especially suited for severe service. Metal roofing materials were investigated to find out why some were satisfactory and others failures. The insulating properties of different metal foils have been carefully studied.

Cast irons of different analyses have been investigated for one manufacturer to determine endurance limits, strength at high temperatures, resistance to creep under load at high temperatures, coefficient of thermal expansion, growth when heated, and other properties. Among other subjects investigated for individual concerns are the creep resistance of alloy steels, dental metallurgy, and the metallurgy of watches. Electrical plating methods are being studied to ascertain whether the process can be improved and to find out whether certain metals can be plated. Investigations for large groups include those on the prevention of embrittlement in galvanized structural steel for the American Society for Testing Materials, on creep and stability of 18-8 stainless steels for the Joint High Temperature Committee of that society and the American Society of Mechanical Engineers, and work on the development of new products for the Copper and Brass Research Association.

That the Battelle Memorial Institute is held in high esteem throughout industry is attested by the fact that its facilities have been made use of from time to time by such well-known concerns as the Republic Steel Corporation, the International Nickel Co., the Federal Mogul Corporation, the Worthington Pump & Machinery Corporation, the Reynolds Metals Co., the Calumet & Hecla Consolidated Copper Co., the Wheeling Steel Co., and many others.

The motto over the Institute entrance reads "Original Research is Mankind's Most Powerful Weapon in Solving the Problems of Nature." This is the thought that the Institute staff is constantly endeavoring to translate into action.

# Up-to-Date Heat-Treating Equipment is Needed

By D. A. SHAW

Obsolete heat-treating methods and equipment are causing great losses in many manufacturing plants. The steel companies have developed materials for practically every purpose, but comparatively few plants have modern heat-treating equipment that permits the maximum results to be obtained from present-day steels.

One of the problems of tool steel producers is to obtain correct heat-treatment of their steels in the plants of steel users. Equipment and methods in different plants vary to such an extent that it is difficult for the steel manufacturer to give specific directions for heat-treatment. Owing to the lack of modern equipment, many manufacturers depend on the skill of the heat-treater, his knowledge of the requirements of the tools and dies, and his care and ability to produce the quality desired.

Control of time and temperature in both hardening and tempering have always been important factors, and recently atmospheric control has been added to these. Many plants have equipment too old to obtain good results, with hardly any means of controlling or determining temperatures. Of course, many new plants have up-to-date equipment, but some older plants use equipment installed twenty-five or more years ago. Recently a representative of a well-known steel company stated that in the territory that he covers, there is only one plant that has thoroughly modern heat-treating equipment.

It is not possible to obtain the maximum results from modern machines unless they are provided with tools made from the best cutting materials, properly heat-treated. It is a penny-wise and pound-foolish policy to buy modern machine tools and put improperly heat-treated cutting tools in them.

There is available today a wide variety of heat-treating equipment, so that anyone can select equipment to meet his own particular requirements. The cost of such modern heat-treating equipment for the average plant is but a small percentage of the total investment in machinery and tools. When one considers that the proper heat-treatment sometimes will increase the productive life of a tool from two to four times, it is difficult to conceive of a better investment than that made in proper heat-treating equipment.

* * *

## Trade Promotion Tour to the Soviet Union

A trade promotion tour to the Soviet Union, sailing from New York on the S. S. *Manhattan* June 21, is being organized by the American-Russian Chamber of Commerce. Invitations are being extended to trade groups and technical societies to join this tour. The travel details are in the hands of the American Express Co., 65 Broadway, New York City, who has arranged the itinerary. Arrangements can be made for traveling in Europe at the end of the Soviet tour.

# Dowel-Pins and Their Use in Diemaking

By LOUIS PICKETT

**Practical Points on Determining Size, Finish, and Fit Allowance**

DOWEL-PINS serve not only to locate or relocate and align mechanical parts of a tool or machine, but also to resist shearing action when necessary, as is often the case with bending and forming dies. A somewhat exaggerated example of the latter application is shown in Fig. 1.

There are two common types of dowel-pins, tapered and cylindrical or straight. The first is used mostly in locating parts on jigs and fixtures, and machine parts that rarely, if ever, will be removed from their original setting. The second or cylindrical pin is used where parts are removed and relocated several times during the life of the tool, as in the case of dies. The cylindrical pin is the more accurate but not so simple to fit. The taper pin has the advantage that, should the mechanic ream the hole slightly larger than specified, he can remedy this condition by driving the pin down a little farther or by using the next size reamer.

### *Advantages of Hardened Pins*

Straight or cylindrical dowel-pins should be hardened and ground. On cheap tools, soft dowel-pins made from drill or Bessemer rod are used. Hardened and ground pins will not tear and stick so easily as soft pins and hence, eliminate a serious fault. Since tool-steel pins are usually too expensive, the commercial practice is to use machinery steel, pack-hardened, and ground in a centerless grinder for this purpose. Cylindrical dowel-pins must be straight for the entire length of the pin, for if the pin is removed from its setting or housing and driven back the reverse way, it will fit too tightly or too loosely, and perhaps be ineffective. Also a pin that is not round does not assure positive alignment. The ends of all pins should be beveled enough to prevent them from being peened out of shape when the pin is driven into position.

A steel driving punch used to remove or set dowel-pins should be about the same diameter as the dowel-pin in order to prevent distorting or peening of the ends. Brass driving pins are better in this respect, but they bend very easily in service. A mixture of white lead and mutton tallow is a very good lubricant for dowel-pins.

### *Determining Size and Location of Dowel-Pins*

The size of the dowel-pin is governed by its application. For locating nests, gage plates, etc., pins from 1/8 to 3/16 inch in diameter are satisfactory. For locating dies, the diameter of the dowel-pin should never be less than 1/4 inch; the general rule is to use dowel-pins of the same size as the screws used in fastening the work. For example, suppose 1/4–20 screws are being used, then the diameter of the dowel-pins used should be 1/4 inch. On bending dies, the dowel-pins should always be a trifle larger rather than smaller, in order to withstand the shearing action of the die.

Two dowel-pins are usually sufficient to locate dies made of one piece of steel; the same is true regarding the punch. If the die is made of more than one piece, as in the case of follow-dies, each piece should have its own set of two pins. Sectional dies are usually set into a saddle and the sections are so ground that they interlock, thus eliminating

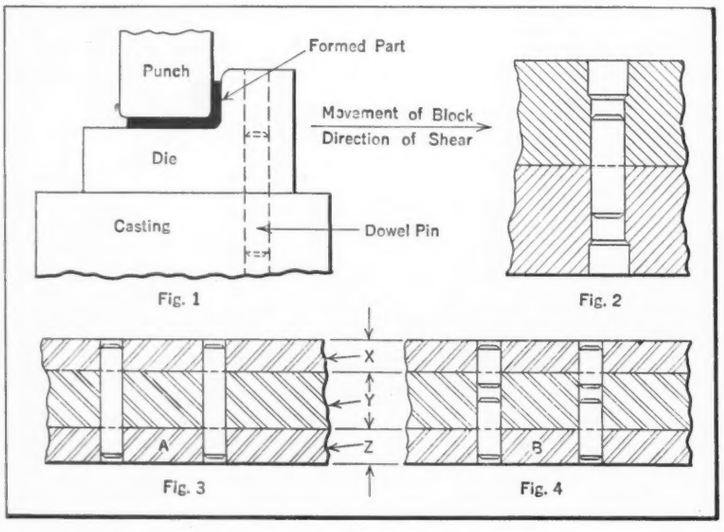



Fig. 1. Diagram Illustrating Shearing Action on Dowel-pin. Fig. 2. Properly Fitted Dowel-pin with Ends of Hole Relieved. Figs. 3 and 4. Two Methods of Locating and Fastening Three Plates

the necessity of doweling each section, although pins are used as a precautionary measure. Dowel-pins on any one piece should always be located as far apart as possible. To prevent any errors in assembling the die, the dowel-pin holes should never be set diametrically opposite each other.

### *Fit and Finish Requirements of Dowel-Pin Holes*

It is important to have the dowel-pin hole smooth and free from reamer or tool marks. If two soft parts, such as punch pads and holders, are to be doweled together, little trouble is experienced in machining two holes to the proper size. Usually they are machine-reamed 0.002 inch under the size of the dowel-pin and reamed to size with a hand expansion reamer. For pins from 1/4 to 1/2 inch in diameter, the diameter of the hole should be from 0.00075 to 0.001 inch smaller than the size of the pin. This applies only to the use of hardened and ground pins inserted in soft material.

In considering hardened dies, 0.0002 or 0.0003 inch difference in diameter is sufficient for the proper drive fit of the dowel-pin. Dowel-pin holes in dies are finished to size by one of two methods—they may be reamed and lapped, or they may be reamed and ground. In the first method, the hole is reamed about 0.002 inch under size before hardening, and then lapped to a drive fit after hardening. In the second method, the hole is reamed 0.008 to 0.012 inch under size before hardening, after which it is ground to within 0.0005 inch of the drive fit size. It is then necessary to lap the hole to the proper size. This prevents grinding the hole too large, thus necessitating the use of larger pins.

### *Fitting Dowel-Pins by Shearing*

A method that is gaining in popularity is to shear the dowel-pins into their housing. The pins are first fitted into the hardened die, which is conveniently used as a guide, and then driven into the soft casting or material to which the die is to be secured. The pin must be made of tool steel, hardened and ground. The shearing end of the dowel must be ground to a sharp corner, which is slightly broken to prevent tearing of the soft material. No more than 0.002 inch on the diameter should be allowed for shearing. This method not only guarantees a good fit, but also saves the reamers and reduces the labor cost.

The exact amount to be allowed for lapping or grinding depends on the characteristics of the steel. The allowances specified in the preceding have given good results on the steels generally used for dies. Soft plugs are inserted in hardened blocks when it is necessary to locate a nest after hardening or when it is impossible to spot the dowel-pin hole from the hardened piece. In such cases, the hole for the soft plug is located in approximately the required position in the piece to be hardened and drilled. The hole in the other piece can then be used for spotting, drilling, and reaming the soft plug, which is inserted after the hardening operation.

The question often arises as to what is considered a good driving fit for dowel-pins. The general rule is that all dowel-pins up to 1/2 inch in diameter must be so fitted that they can be driven in or out by moderate blows from a 12-ounce hammer. Dowel-pin holes should be ground or lapped straight without taper or bell-mouth. The bell-mouth condition is usually produced by allowing the stroke of the lap to extend beyond the end of the hole or the face of the piece. Grinding the holes overcomes such trouble, but as a grinding machine is not always available, it is sometimes necessary to lap the holes.

Two methods of doweling three plates together are illustrated in Figs. 3 and 4. In the method shown in Fig. 3, two dowel-pins pass through all three plates. If the plate *Y* is more than 1 inch thick and hardened, difficulty will be experienced in aligning the three plates, although this method is often used. In the method shown in Fig. 4 two dowel-pins are employed for each hole, each pin aligning two plates. This method can only be used where plate *Y* is thick enough to permit such a construction.

Excessive bearing surface is of little use and is expensive. The length of the bearing surface of a dowel-pin should be about one and one-half to two times its diameter in each plate or part to be doweled. Excessive surface only demands more labor per hole during machining, and may cause trouble when the dowel-pin is driven into and out of the hole. The remainder of the hole should be relieved so that it is 1/32 inch larger in diameter than the dowel-pin, as shown in Fig. 2.

The principles underlying the fastening of dies to die-shoes and punch pads to punch-holders vary with the method of design employed in different manufacturing plants. Often it is necessary to remove the die proper from the die-shoe in order to grind it. This means that the screws and dowel-pins must be removed from the die. Many tool designers believe that the dowel-pins should be a drive fit in both the die and shoe. Others feel that driving of the pin into and out of the shoe will enlarge the hole and cause a poor fit. Hence, they believe that the dowel-pin should be a sliding fit in the die and a drive fit in the shoe. The die can then be easily removed for grinding.

### *Should the Dowel be a Drive Fit in the Die or Shoe?*

The better and more accurate method is to have the pin a drive fit in both the die and shoe. When the die is removed, it is not necessary to remove the dowel-pins. Driving them out of the die into, but not out of the die-shoe, partly overcomes the trouble experienced from the holes becoming larger or the pins becoming smaller. Driving the dowel-pins into and out of the die-shoe or punch-holders, particularly if the latter are of cast iron, will cause, in time,

a loose-fitting pin. The proper thing to do then is to use the next size dowel-pin or plug the dowel-pin holes in the shoe with a large soft plug and relocate the die.

A loose-fitting dowel-pin may cause a great deal of trouble, and should not be tolerated. The inspector should examine every die for this defect before it is assembled. He should never approve of a drive fit tested only by driving the pins about 1/8 inch, because one cannot ascertain in this manner whether the pin is a drive fit in both the shoe and the die or a drive fit in one and a loose fit in the other. A dowel-pin that is too tightly fitted can cause just as much trouble as a pin that is too loose. Pins that are set with a great deal of force usually "freeze," and can only be extracted with care, and even then with much damage to the pin and its housing. Usually if the housing is soft, the hardened pin will "pick up" metal inside the hole and tear it full of ridges when the pin is driven out.

* * *

## Sharpening Drill to Cut Clean-Edged Holes in Sheet Metal

By HAMMOND MATHEWS, District Superintendent
Western Colorado Power Co.

The writer would like to comment on the drill illustrated and described by Daniel L. Mather on page 399 of March MACHINERY. A drill so sharpened is very useful. The writer has employed it for several years—in one instance, for drilling holes from 1/2 inch up to 1 1/2 inches in copper bus bars used on switchboards and bus members, in thicknesses of from 1/16 to 3/8 inch. It has also been used on brass.

Previous to learning of this type of drill point, it had not been possible to drill copper bus bars with any speed or accuracy. A drill ground as shown in the article referred to will give good results when copper or brass is to be drilled, irrespective of the size of holes to be finished. The slight burr on the bottom side of the hole can be easily trimmed off; in fact, on a hurry-up job on brass or copper, a jack-knife will do it neatly. This method of grinding drills is not generally known, and it is a good thing to call it to the attention of MACHINERY'S readers.

* * *

In 1932, the railroads of the United States paid in taxes to federal, state, and local governments over 38 cents out of every dollar of net earnings. This is the highest ratio for any year since 1920. As a matter of fact, the taxes of the railroads support the schools of many of our rural communities. The amount of taxes paid in 1932 by the railroads was over $275,000,000, which was about three times the amount paid in dividends that year.

## Conditions Greatly Improved in the British Machinery Industry

The British machinery industry is in a very satisfactory condition, according to a report from Consul George A. Makinson of Birmingham, England. Since the middle of last year, there has been a decided up-swing in British industrial activity. The automotive industry has been particularly active, the production figures for 1933 establishing an all-time high record for Great Britain. The Austin Motor Co., Ltd., has engaged close to 3000 additional men since the beginning of the year and recently was advertising for still more help. This firm has been buying machine tools at an average rate of $30,000 a week. Since the war, it has spent approximately $75,000,000 for equipment. Railroad shops, aircraft builders, general machinery builders, and other large engineering plants are also reported to be busier than they have been for a long time.

British machine tool builders are obviously getting the bulk of the new machine tool business resulting from the general industrial revival. The present exchange rates, however, favor sales of American machine tools, and one American sales representative reports that his 1933 sales were 22 per cent ahead of 1932, and that the first months of 1934 show an increase of 38 per cent over the corresponding period of 1933.

While the British machine tool builders have been doing a steadily expanding business in the home market, they have been losing ground in foreign markets. The exports in 1933 were much below those of 1931 and 1932. Of these exports, Soviet Russia took more than one-half in 1931, over three-fourths in 1932, and about one-half in 1933. The Soviet market for British machine tools declined during the first months of 1934. This is doubtless due to the likelihood of more machine tools being supplied by the United States, following the recognition of the Soviet Government.

* * *

### The National Metal Exposition

The annual National Metal Exposition and the National Metal Congress to be held in the Port of Authority Building, 111 Eighth Ave., New York City, during the week of October 1 to 5, promises to be an event of unusual interest. Advance sale of exhibit space exceeds that of any of the last four expositions, and it is quite certain that, both in number and in size, the exhibits will be greater than in any year since 1929. In connection with the exposition, meetings will be held by the American Society for Metals; the American Welding Society; the Institute of Metals and the Iron and Steel Divisions of the American Institute of Mining and Metallurgical Engineers; and the Wire Association.

# Form-Turning on Vertical Turning and Boring Mills

**Methods and Equipment Employed in Turning Spherical and Irregular Shaped Work**

By M. M. McCALL

ON vertical turning and boring mills the operation of machining surfaces other than flat or cylindrical is termed forming. With specially shaped tools, work can be formed on small surfaces by the same methods as are used for flat and cylindrical work, but the operations to be described in this article are those in which the tool is caused to follow the outline of the formed work. Taper cutting, which produces conical surfaces, is performed by forming operations which were described in March MACHINERY, page 406. This article will be confined to the cutting of curved surfaces.

The guide bar attachments for cutting tapered work, shown in Figs. 2 and 9 of the previous article, are equally applicable for cutting curved surfaces, as the slot in the bar can be cut to any shape within reasonable limits, and the shape of the bar made to conform to the slot. Guide rollers must be used in all curved slots, and as the boring-bar is guided vertically by the roller, the curve must not be too steep. If the direction of travel of the boring-bar is reversed, the change of direction must not be abrupt.

The left-hand head of a Colburn machine, shown in Fig. 1, is arranged for forming the outline of steam turbine disks. The cam-plate is attached to a bracket which is held by supports mounted on the rear of the cross-rail. A roller, clamped to the rear of the boring-bar, guides the bar vertically as the saddle is fed along the rail with the bar feed disengaged. Different curves can be cut by substituting suitable cam-plates, and small tapers can be obtained by swiveling the cam-plate bracket.

Fig. 2 shows a Niles machine with both heads arranged for similar work. The cam-plates (not shown) are mounted in the bracket that extends from one housing to the other. The screws in front permit vertical adjustment of the bars when the roller is in the slot.

*Fig. 1. Finishing Steam Turbine Disk Forging on 72-inch Turning Mill, Using Special Taper and Radius Forming Attachment*

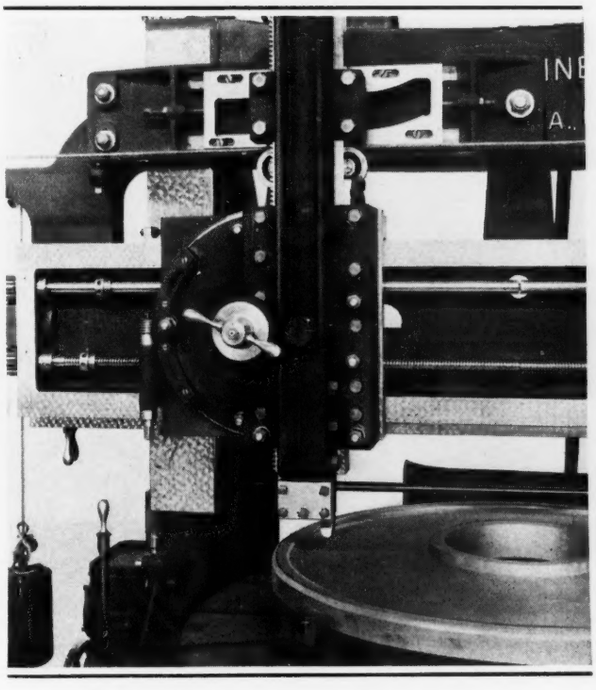
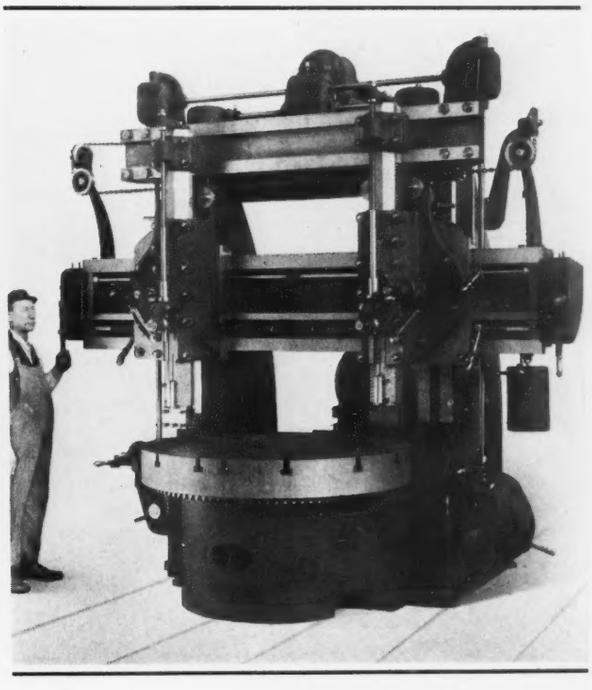


*Fig. 2. Boring Mill with Two Heads Arranged for Turning Work of a Similar Type to that Shown on the Machine in Fig. 1*



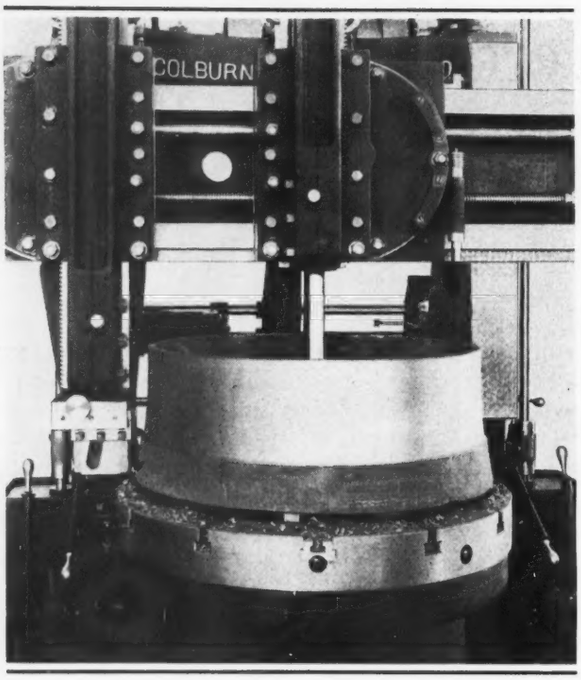



*Fig. 3. Turning Concave Face of Sand-reel Friction Pulley with Crowning Attachment on One Head while the Other Head Performs a Boring Operation*

In Fig. 3 is shown a Colburn machine engaged in concaving the face of a pulley with the left-hand head while the right-hand head is performing a boring operation. The cam-plate is held in a bracket fastened to the bottom of the saddle. The cam roller is attached to a special tool-holder which slides horizontally in a tool-holder block fastened in the lower end of the boring-bar. As the bar is fed vertically, the cam roller guides the tool-holder horizontally. Other curved work, including the crowning of pulleys, can be performed by using suitable cam-plates.

Work can also be formed to a radius by surrounding the boring-bar with a bracket attached to the bottom of the saddle. A swinging tool-rest is centered in the bracket and keyed to a gear that meshes with the boring-bar rack when the bar is extended. As the bar is fed vertically, the rack rotates the gear and swings the tool-rest. The tool is held in a holder which can be adjusted along a tool-slide to obtain different radii.

Turning attachments for producing balls or spherical cavities, as applied to a Niles boring mill, are shown in Figs. 4 and 5. The circular feed is obtained for both attachments by feeding the boring-bar vertically. The saddle is equipped with a split nut on the cross-feed screw which is opened to allow the saddle to float along the cross-rail during the operation. The height of the cross-rail must be accurately set so that the center of the bracket on the rail coincides with the center of the work.

A special boring mill head with circular feed is shown in Fig. 6. The circular feed is obtained from the regular bar feed-rod by means of a worm and wheel and a pinion meshing with teeth cut in the bar swivel. Provision is made for disengaging either the bar feed or the circular feed when the other is in use. With the tool at the center of the table, as shown in the illustration, part of a spherical hole is bored. By placing the head in other positions along the cross-rail, cuts to a radius can be taken at different places along the surface of the work.

It is also possible with this head to engage the cross-feed to the saddle and the circular feed simultaneously. By varying the amount and direction of the feeds, a series of irregular shaped curves can be developed. In using the circular feed, the bar feed must be disengaged to prevent the bar feed worm-wheel from overhauling the worm, as the rack pinion is rotated slightly by the angular motion of the boring-bar. Owing to this overhauling

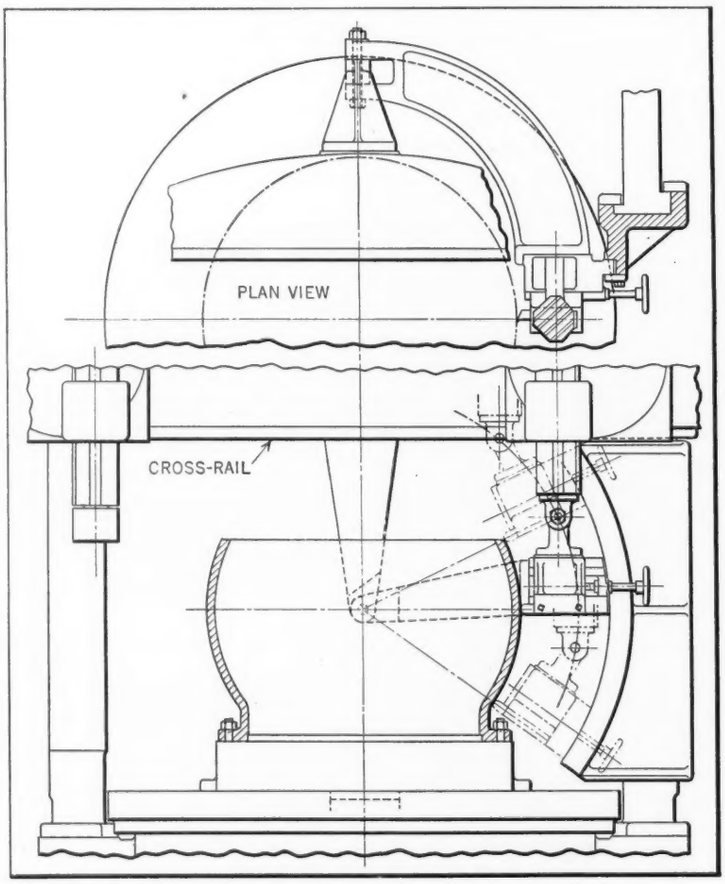



*Fig. 4. Boring Mill Equipped for Turning Balls or Spherical Surfaces*

*Fig. 5. (Right) Turning Internal Spherical Surface on a Boring Mill, Utilizing the Vertical Feed to the Boring-bar*

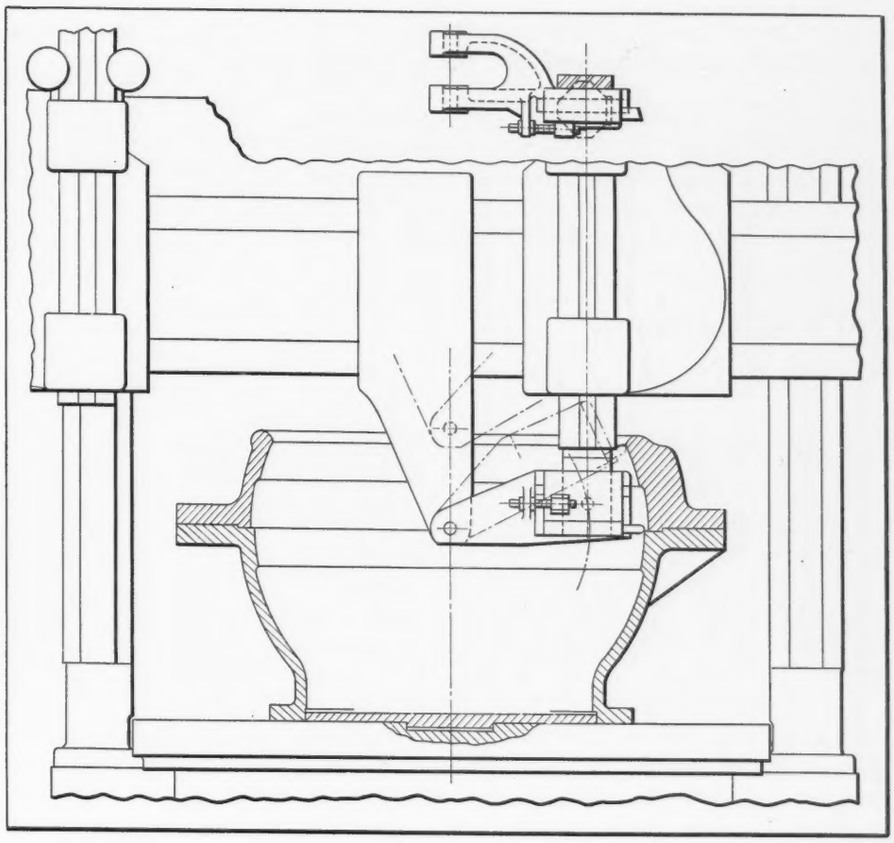
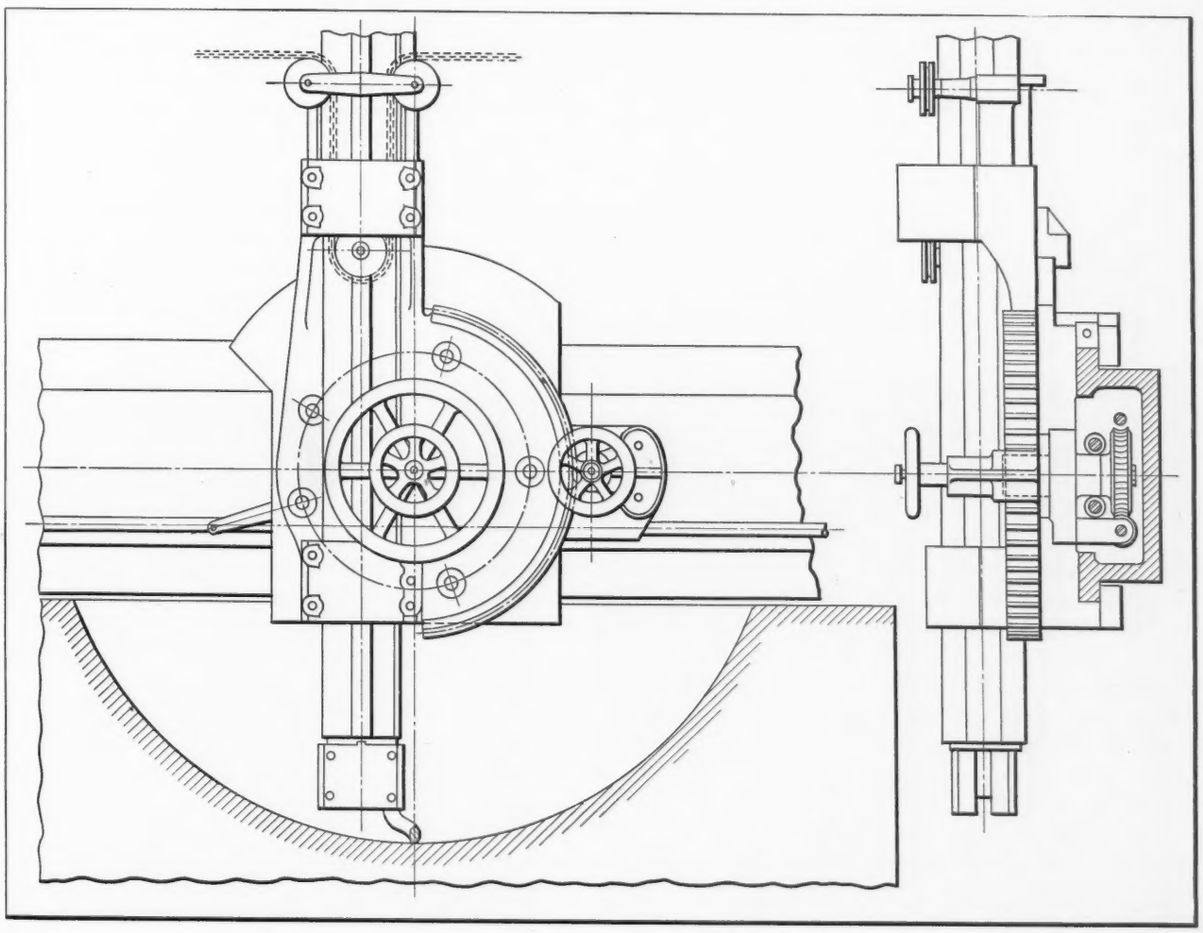


*Fig. 6. (Below) Boring Mill Head of Special Design, Provided with Circular Feed which is Obtained from the Regular Bar Feed-rod*



action, it is not feasible to use a combination of the circular feed and the bar feed to develop irregular curves.

The best cutting conditions are obtained with the ball turning and radius turning attachments, as the cutting is performed by the same surface of the tool on the entire curved surface of the work. When the curve is developed by a combination of movements, the cutting surface of the tool changes with every change of the curve. This must be taken into account in shaping the tool.

* * *

## New Buying of Shop Equipment Distributed Among Many Industries

In speaking about sales of machine tools made since the first of the year, C. S. Stilwell, manager of sales of the Warner & Swasey Co., Cleveland, Ohio, points out that at present there is a very wide distribution in buying activity. Since the first of the year, the company has sold turret lathes to concerns representing thirty different industries, including manufacturers of machine tools, brass goods, printing machinery, steam turbines and engines, oil-well equipment, electrical supplies, electric motors, bronze bearings, welding equipment, pneumatic tools, textile machinery, aircraft engines, heat regulators, rolling-mill machinery, and automotive parts. Also, several railroads and government arsenals and navy yards have been in the market. Mr. Stilwell anticipates continued satisfactory machine tool business.

## The Job Ahead for the Machine

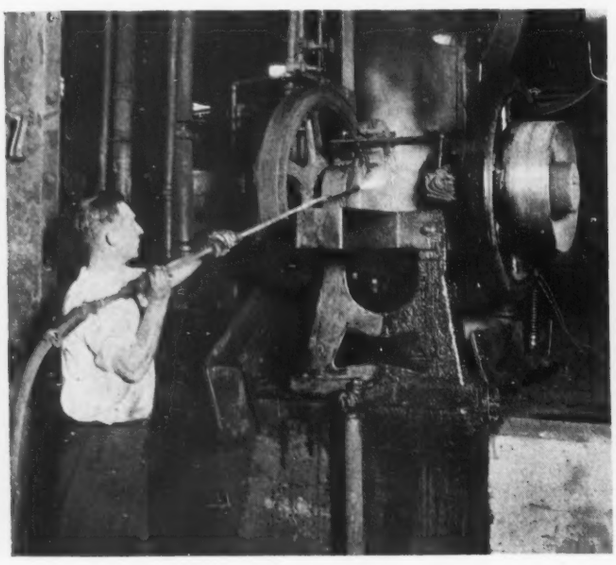
An informative booklet, "The Job Ahead for Machinery," has been published by Allen W. Rucker in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc. The booklet can be obtained by application to this company at 11 Main St., Ansonia, Conn. This little book discusses the question of technological unemployment and, using data from the U. S. Census reports, shows that there is no basis for the contention that the machine has permanently reduced the number of jobs available; rather it has created many more new jobs and has contributed largely to social and economic progress.

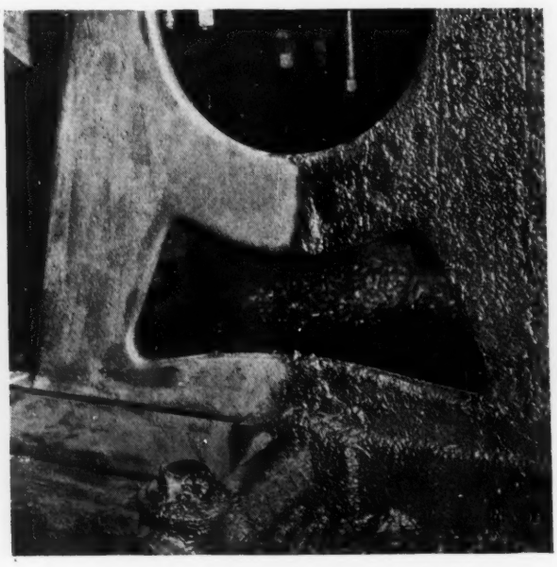
Viewed from the perspective of thirty years, it is clear that whatever trend there may be toward permanently reduced employment in industry, it is confined wholly to children under sixteen and to minors between the ages of sixteen and twenty. No one will object to the part the machine has played in abolishing child labor, nor to the increased opportunities for education that make employment in early youth less general than in the past.

At the end of the thirty years that marked the greatest development that has taken place in the machine era (1900–1930), there are larger percentages of both adult men and adult women employed in the manufacture and distribution of goods than was formerly the case.

It is difficult to see how we can maintain the rate of improvement in the standard of living that we have seen during the last thirty years without greatly augmenting the use of machinery and improved manufacturing processes.

(Left) Water at a Temperature of 200 Degrees F. and at a Pressure of 175 Pounds per Square Inch Being Used to Remove a Heavy Accumulation of Grease from a Machine. The Water Vapor is Supplied by a "Hypressure Jenny," Made by the Homestead Valve Mfg. Co., Coraopolis, Pa. (Right) Surfaces Cleaned by the "Hypressure Jenny" Make a Striking Contrast with Uncleaned Surfaces. Sludge, Paint, Oil, and Other Substances can be Removed from Surfaces by the Same Method.





# Drawing and Polishing Stainless Steel

The Possibilities of Drawing Stainless Steels—Suitable Drawing Lubricants — Annealing Methods — Pickling Baths — Polishing Practice

By R. F. JOHNSTON, Inspection Department
American Sheet & Tin Plate Co., Pittsburgh, Pa.

STAINLESS steels can be formed or drawn to a much greater extent than ordinary steels—on the average, about 50 per cent more. This is due to the fact that they have much greater ductility. However, it should be remembered that more force must be exerted by the power press, since the yield point of stainless steels is appreciably greater than that of the common steels. This necessitates that the presses and dies for drawing stainless steels must be more rugged and powerful than those required for producing the same pieces from milder steels. When equipment designed for drawing ordinary steels is to be used for working stainless steels, slower operating speeds are advisable.

### *Heavy Lubricants are Necessary in Drawing Stainless Steels*

Stainless steels are so dense that when they are being drawn there is a tendency for the lubricant to be squeezed completely from the sheet and die surfaces. If this occurs, the sheet and die may gall or "freeze" together. Also, particles of stainless steel torn from the sheet may adhere to the die surfaces with harmful results. To avoid such occurrences, heavy lubricants are essential.

The so-called water-soluble drawing compounds are satisfactory from several standpoints. A lubricant that the writer has found particularly suitable for use in drawing parts from stainless steel consists of linseed oil and whiting (or white lead or lithopone), mixed together to a fairly thick consistency, after which from 5 to 10 per cent of sulphur is added. The sulphur forms a slight deposit on the die surfaces that prevents galling of the sheet to the die.

Another reason why a heavy lubricant is necessary in operations on stainless steels is that there is no thin oxide film on the sheet, as with open-hearth steel. Such a film would act as a separating medium to prevent bare metal-to-metal contact in power press operations.

When parts are to be annealed between drawing operations, the lubricant must be thoroughly cleaned off. Otherwise, the piece will scale irregularly, and in subsequent polishing, the heavily scaled portions will be difficult to finish. Also, the stainless steel is likely to become carburized or otherwise impaired by the decomposing lubricant.

When experience in drawing stainless steels was more limited, it was believed that the die surfaces should be highly polished. It has now been found that if the die surfaces are somewhat porous, the microscopic openings will retain sufficient lubricant for the drawing operation. There should, however, be no projections on the die surfaces, even minute ones, because such projections will soon build up sufficiently on this class of work to cause galling.

The clearance between the die surfaces and the stainless steel sheet being drawn should be about one and one-half to two times that allowed for ordinary steel or brass. The allowance for "spring back" should be two or three times that customary with ordinary steels.

Stainless steel can be subjected to severe draws without intermediate annealing, but when annealing is desirable, it should consist of heating the part to 1850 degrees F. or more and quenching in water, although air quenching would be satisfactory if the part were of thin section. The part should be pickled before it is drawn again, in order to remove all oxide. Sometimes this oxide will be so hard that it cannot be ground off. Annealing and pickling may be repeated as often as desired.

Sometimes annealing can be avoided by preheating the stainless steel blanks or the dies, or both, to a temperature of between 200 and 400 degrees F. When this is done, there will be less hardening of the stock during deep drawing.

### *Pickling Solutions Suitable for Stainless Steel*

Pickling can be performed in a solution of hydrochloric (muriatic) acid or its equivalent—sulphuric acid and common coarse salt. Sulphuric acid alone has been found too slow to be practical. If the former solution is employed, it should consist of equal parts of commercial hydrochloric acid and water. A bright finish will be obtained on the work by adding a small amount of nitric acid, say 10 per cent of the hydrochloric acid. This solution should be used at a temperature of about 140 degrees F.

When sulphuric acid and rock salt are used, the proportions should be 10 per cent sulphuric acid, 10 per cent salt, and the remainder water. This solution should be used at a temperature of about 180 degrees F.

After the pickling operation, the acid should be rinsed off in hot water, and then the work should be immersed for a few minutes in a 10 to 20 per cent nitric acid solution heated to from 125 to 140 degrees F. This treatment should be followed by thorough washing.

### *Imparting a High Polish to Stainless Steel Pieces*

When parts drawn from stainless steels have large flat surfaces and the amount of undrawn surface is much greater than the drawn surface, as in the case of table and stove tops, it is profitable to produce the parts from polished sheets. Generally speaking, however, comparatively small parts and deep-drawn parts cannot be drawn economically from polished stainless steel sheets, because the finish is likely to become marred in the drawing operation, necessitating repolishing. Therefore, kitchen utensils and similar articles are nearly always polished after being drawn.

Stainless steels require a harder abrasive for polishing than ordinary steels. When a fairly high finish is desired, it is customary to polish in three steps, using aluminum oxide of grit numbers 80, 100, and 120 in succession. A grease or lubricant is generally used in the final operation. Tallow or stearic-base grease is preferred by the writer to the petroleum-base lubricants.

For a mirror-like finish, finer grits of aluminum oxide are used, supplemented by a chrome-oxide rouge. If a buffing finish is required, the buffing should be done with an iron-free rouge in order to obtain the proper color and luster. Buffing is done with an unsewed rag wheel, the rouge being applied to the face of the wheel by means of a stick. Very high speeds are recommended for buffing. Set-up wheels are used in polishing operations.

Since the heat conductivity of stainless steels is much less than that of ordinary steels, care must be taken in polishing operations to avoid "burning" the part. This is especially likely to happen with parts of thin section if too much pressure is applied or too great a speed is used.

### *Appearance and Strength of Stainless Steels*

Stainless steels are produced in sheets ranging from No. 26 gage up to a thickness of 3/16 inch. Greater thicknesses are termed plates. In the past, the lasting fine appearance and corrosion resistance of stainless steels have been particularly stressed, but it should be remembered that the high strength of stainless steels enables them to be employed in thinner sections than ordinary steels when strength is a factor. Stainless steels can be supplied with a tensile strength as great as 250,000 pounds per square inch, and they can be drawn and formed when the tensile strength is as much as 150,000 pounds per square inch, provided the draw is not too severe. This property has led to the construction of complete railroad trains of stainless steel. The high strength of stainless steel is leading to an increasingly extensive use for structural purposes, as well as for light-weight construction of mobile equipment.

# Hollow Set-Screw Standards

In connection with the proposed American Standard socket type set- and cap-screws developed under the rules of the American Standards Association, the Allen Mfg. Co., Hartford, Conn., has addressed a communication to the trade raising two questions:

1. Should the socket-head cap-screw be made with or without a fillet under the head?
2. Should the Long Series be continued in the standard list of wrenches?

Commenting upon Question 1, the Allen Mfg. Co. says: "A screw with a fillet is stronger than one without a fillet; there is less danger of breakage under the head. Fewer screws are required for a desired holding effect. If the screw has a fillet, the hole in which it is to be used must be countersunk or made enough larger than the screw to clear the fillet."

Commenting upon the second question, the company makes the following statement: "The proposed standards list two lengths of hexagon wrench long arms—Short Series and Long Series. The short-arm length is the same in both series. The long arm in the Long Series is from 60 to 80 per cent longer than the long arm in the Short Series.

"The Short Series wrenches can be put in the box in which the screws are stocked and shipped. The Long Series wrenches cannot.

"The 3/32- and 1/8-inch hexagon wrenches, Short Series, can be twisted or broken by hand without the use of an extension when tested in a screw. The other sizes can be destroyed only by the application of extraordinary strength or greater leverage."

The company submits these questions and the comments upon them to the manufacturers and users of the types of screws under discussion, and would welcome comments sent directly to the Allen Mfg. Co., P. O. Drawer 570, Hartford, Conn.

* * *

The Delaware & Hudson Railroad is exhibiting at the World's Fair in Chicago an ancient locomotive dating back to 1827. This is shown beside one of the company's most modern high-speed engines.

# An Air-Driven Burring Tool that Saves Time in a Railway Shop

By HERBERT OLIVER

Floating bushings in the main driving-boxes of Canadian National locomotives are provided with a large number of 1/4-inch countersunk holes. These holes permit grease to be forced into the bearing by means of Alemite fittings. In drilling the holes, a slightly burred edge is left on the inside. To remove these burrs with a hand file took about one-half hour, as there are usually eighty-four holes.

In order to reduce the time required for this operation, an air-driven tool (as shown in Fig. 1) was devised at the Stratford, Ontario, shops of the railway system mentioned. This tool has cut down the time for the burr-removing operation to two minutes. Compressed air at a pressure of 90 pounds per square inch is used to drive the rotor *A*, of the tool (see Fig. 2), at a high speed. Keyed to this rotor is a spindle *B* having a hole or socket that receives the shank of a rose reamer *C*. Ball *D* takes the thrust exerted on the tool. Welded to one side of housing *E* is a fitting through which the air is delivered to the rotor. The rotor has twenty teeth or vanes.

For this operation, the floating bushings are placed on a short piece of channel iron, as illustrated in Fig. 1. The channel iron holds them steady, and yet the operator can easily turn the bushings as required until all burrs have been removed. Other bushings are handled in the same way.

Fig. 1. An Air-operated Tool that Has Cut Down the Time of a Burr-removing Operation from One-half Hour to Two Minutes

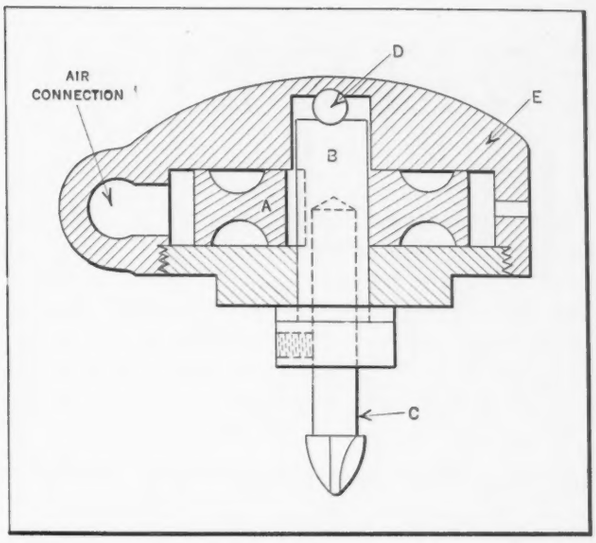



Fig. 2. Cross-sectional View of the Air-driven Burr-removing Tool Shown in Use in Fig. 1

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## Tire-Mold Methods are Modernized by Arc Welding

The tire molds of the Mansfield Tire & Rubber Co., Mansfield, Ohio, are being brought up to date by arc welding, resulting in an estimated saving of from $15,000 to $18,000 through the elimination of the expensive "bullringing" operation and the speeding up of the work. The change required is in the annular grooves or rabbets which register the halves of the molds, these rabbets originally having a right-angle profile. To make the molds close properly without undue wear under constant use, the rabbets are given a beveled instead of a right-angle form. This requires cutting away the female half of the mold to the desired angle and building up and machining the male half to the same angle. A 200-ampere General Electric arc welder and Type M welding electrodes are used to deposit the additional metal required.

* * *

## Soviet Industries Increase Output

According to the *Economic Review of the Soviet Union*, the production of automobiles in Soviet plants in 1933 reached a total of 49,700 cars; 73,400 tractors were also built. The program for 1934 calls for 72,000 cars and 115,000 tractors. The locomotive works in the Soviet Union built 827 engines in 1933 and are planning to build 1250 this year.

# EDITORIAL COMMENT

A Congressman returned recently to a farm in Kansas where he worked as a boy, and there he saw three men using machinery to harvest a crop that once would have required thirty men. As quoted in the *New York Tribune*, this is what the Congressman said: "Here was a picture of mass production by machinery. The harvest hand is gone. The cotton picker is going. Cows are milked by machinery. Telephones are self-operated. Accounts are kept by machinery. The machinery is self-created. It digs its own materials out of the ground, transports them to the manufacturing plant, manufactures itself, and operates itself."

## And Now We Are Told that Machines Are "Self-Created"

The first inclination of engineers and machinery manufacturers is to smile at so fantastic an idea; and all that the idea would be worth is a smile if the implications were not so serious. The Congressman stated a view that is widely accepted. The engineer can hardly understand how such a fallacy can be voiced by men in public life.

We are told that if we limit production and create a scarcity of the things we need, we shall all be well off; but, on the other hand, if machinery is permitted to aid in the production of an abundance of the things that we require for food, clothing, shelter, and comfort, a great number of us must suffer want. It is difficult to know how to combat such a doctrine, because the mind that will accept unquestioningly such ideas is hardly open to rational reasoning.

In one of his articles, Walter Lippmann points out that if production machinery causes unemployment, there ought to be some relation between the amount of unemployment and the amount of production machinery in use. In 1926, according to the best available estimate, the United States had a work output per person one and one-half times that of Great Britain, two and one-half times that of Germany, and nearly forty times that of China, India, and Russia. Nevertheless, in 1926, practically everyone willing and able to work in the United States was employed, while in England and Germany there was serious unemployment, and in Russia, China, and India the standard of life was so low as to defy even a comparison with our country. If the theory that production machinery is the cause of unemployment were correct, there should, in 1926, have been far greater unemployment here than in Great Britain or Germany.

## Fallacies that Men Want to Believe Are Hard to Combat

How is one to answer the statement that machinery is self-created? Even a man who knows little or nothing about engineering should be able to visualize some of the fundamental processes in producing a machine, though it may be difficult for him to picture in his mind's eye the thousands of men who are put to work by the process of making even the simplest machine. Let us see just who they are and what they do.

There are the miners who mine the iron ore and those who mine the coal for smelting it; there are the thousands of men employed at blast furnaces and in steel mills. The machinery has to be designed by engineers, and the drawings made by draftsmen; and, finally, toolmakers and machinists put the engineers' ideas into concrete shape in iron and steel. Plants have to be built in which the machinery is manufactured; machinery has to be built to build machinery; fuel has to be provided to heat the plant and to carry on the processes within it; accountants, bookkeepers, time-study men, and clerks are needed to keep track of all operations; and transportation is required to carry the materials to the plant and to transport the machines to the customers—and neither trucks nor trains run themselves.

## A Simple Machine—Yet a Thousand Men Helped to Build it

That is how the machinery comes into being that the Congressman tells us is *self-created.*

Again, to quote Walter Lippmann: "The idea that labor-saving machinery makes a nation poorer is a most curious, but a most persistent illusion." Is there no man in high office who, speaking with authority, can make people see—Congressmen and labor leaders included—that the *first* requirement for a high general standard of living is that an abundance of goods be produced to satisfy the desire for the necessities and comforts of life; and *second*, that methods must be found to insure that these goods be consumed and enjoyed by all contributing to their production through their willingness to work?

# Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction ot Automatic Machines and Other Devices

## Release Mechanism for Preventing Damage to Reciprocating Parts

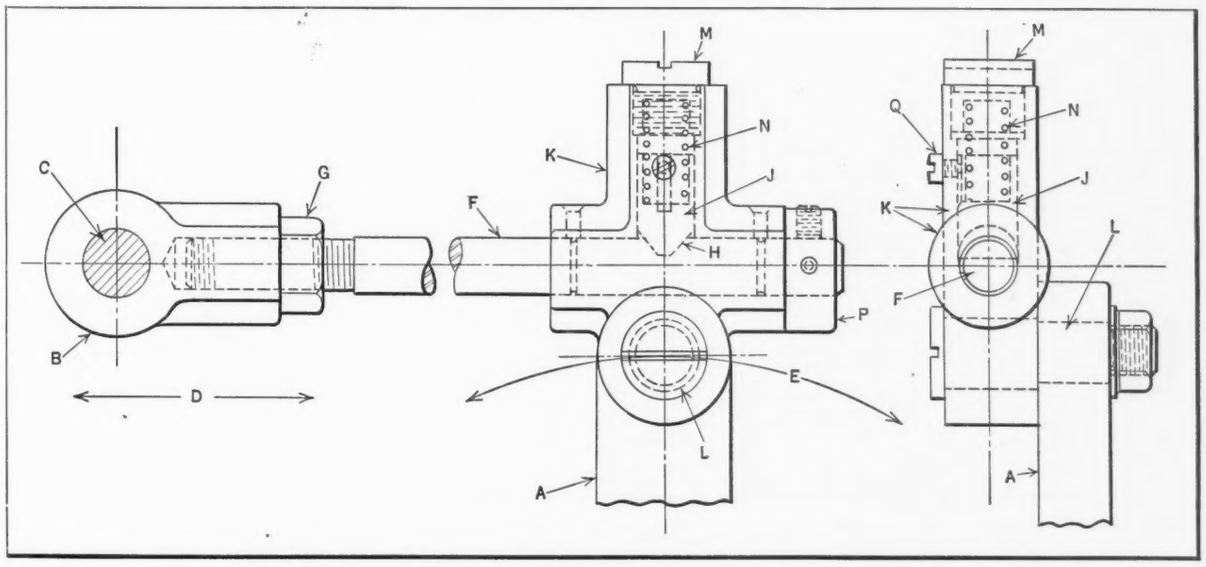
By F. SERVER

Mechanisms for automatically preventing damage to reciprocating parts are sometimes required when there is the possibility of such an occurrence resulting from the jamming or overloading of the machine. A mechanism of this kind is shown in the accompanying illustration. The reciprocating movements of the parts to which this mechanism is applied are obtained by means of the lever *A*, which swings back and forth as indicated by arrows *E*.

Lever *A* is mounted on a shaft (not shown) which is operated by a cam-and-roll mechanism. At *B* is shown a connecting link, through the center of which passes a short shaft *C* by means of which the rocking action of the lever *A* is transmitted to a vertical reciprocating slide. This slide travels back and forth in the directions indicated by arrows *D*, being propelled through the medium of the connecting-rod *F*, which is adjustable in the link *B*. Rod *F* operates in a vertical position instead of in the horizontal position shown in the illustration. This rod is securely locked in place by nut *G*, the adjustment being obtained by making a complete revolution of rod *F*, so that the crosswise notch at *H* will be in the proper position to receive the locking plunger *J*.

Ordinarily, the movement of lever *A* is imparted directly to shaft *C*. The safety unit is provided to prevent breakage in case the machine becomes jammed or overloaded. This safety device consists of the cast-iron housing *K*, which is free to pivot on stud *L* in lever *A*. Screw *M* holds spring *N* in place, so that the plunger *J* is forced into the notch *H* in rod *F*. Under normal operating conditions, the unit acts as a non-yielding driving block. In the case of an overload on shaft *C*, spring *N* yields sufficiently to permit plunger *J* to snap out of notch *H*, with the result that lever *A* and block *K* will reciprocate without imparting any motion to rod *F*, thereby preventing the driven parts from being broken or damaged.

When the obstruction is removed, plunger *J* automatically springs back into notch *H* and the normal operation of the machine is resumed. The collar at *P* is provided to insure a positive driving movement for rod *F* on the down stroke. Thus, the driving movement imparted to rod *F* is interrupted only on the upward stroke. There is a pin-shaped end on screw *Q* that enters a keyway in plunger *J* and thereby prevents the latter member from turning in block *K*.




Release Mechanism for Reciprocating Lev er Designed to Prevent Breakage Due to Overloading or Jamming of Machine Parts

# Adjustable-Speed Feeding Unit for Wire-Cutting Machine

By EUGENE L. SOLTNER

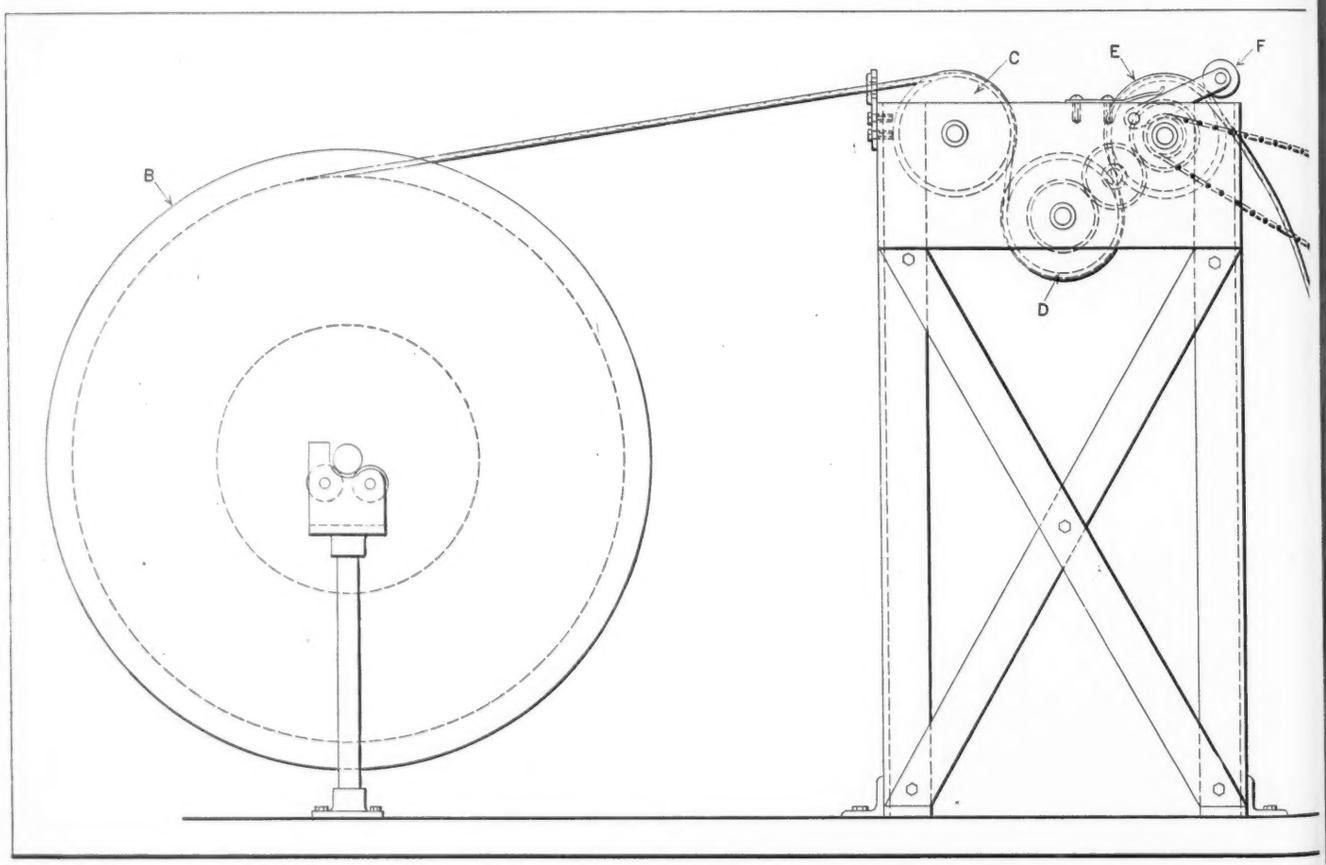
Various lengths of wire for carrying electric current are used in the manufacture of a certain product. These wires are cut to length and the ends are stripped of insulation on a well-known make of wire-cutting machine. The wire comes to the factory wound on heavy spools, a full spool weighing approximately 175 pounds. The inertia of such heavy spools caused an uneven feeding movement that resulted in a variation in the lengths of the wires. To overcome this trouble, an operator was employed to turn the spool, so that a small amount of wire would be kept slack at the feeding end of the machine. It became evident, however, that such an arrangement would be too expensive, as the job appeared to be one that would last for several years. The attachment described and illustrated in this article was built to eliminate the necessity for hand-feeding.

The attachment is in the nature of feed-rolls using sheaves instead of rolls. These sheaves are mounted on suitable standards and placed between the wire-cutting machine *A* and the spool of wire *B*. There are three large sheaves *C*, *D*, and *E*, and one idler *F*. Two of the main sheaves *E* and *D* are drivers, being geared together and driven by a sprocket and chain which is connected to a cross-shaft *H* at the end of the machine.

In the driven sprocket, which is a part of the feed-rolls, is a free-wheeling clutch. The driving shaft of the feed-rolls to which this clutch is keyed projects several inches beyond the side of the standards and is squared for a crank-handle. This permits the train of sheaves to be turned forward independently of the driving mechanism.

The original driving shaft of the machine was replaced by a longer one. To this longer shaft is secured a large friction disk *G*. Adjoining this disk and attached by suitable mountings to the end of the machine is a cross-shaft *H*. To the end of this shaft is secured the driving sprocket-wheel. Also keyed to this cross-shaft is a small friction wheel *I* which contacts with and is driven by the large friction disk.

Set into a groove in the cross-shaft is a small screw *J*. This screw is threaded through a half-nut which is secured to the side of the driven wheel. The screw is retained in the shaft by means of a plate which is fastened to the end of the shaft. By means of this screw, the driven wheel is moved back and forth across the face of the driving disk to obtain any desired ratio of speed. To facilitate setting the driven wheel, the cross-shaft is scored and numbered every half inch, the numbers corresponding to the length of wire that will be fed by the rolls for that particular setting.




Adjustable-speed Friction-driven Feeding Unit for Wire-cutting Machine

In operation, after the wire has been laced through the feed-rolls and into the machine, the operator places the crank-handle on the squared end of the shaft previously referred to, and turns the feed-rolls forward, feeding a small amount of slack wire ahead of the wire-cutting machine. The wire-cutting machine is then started, which also serves to start the feed-rolls. If the length of wire is one that has been previously cut, the setting, no doubt, will be fairly accurate and the same amount of slack wire will be maintained. However, should the length of wire to be cut be an odd size, an approximate setting is made.

An occasional glance from the operator, while pursuing other duties, determines whether the feed-rolls are losing or gaining on the wire-cutting machine. In either case, a turn of knob *K* at the end of the screw in the cross-shaft readjusts the feed. This can be done while the machine is running.

* * *

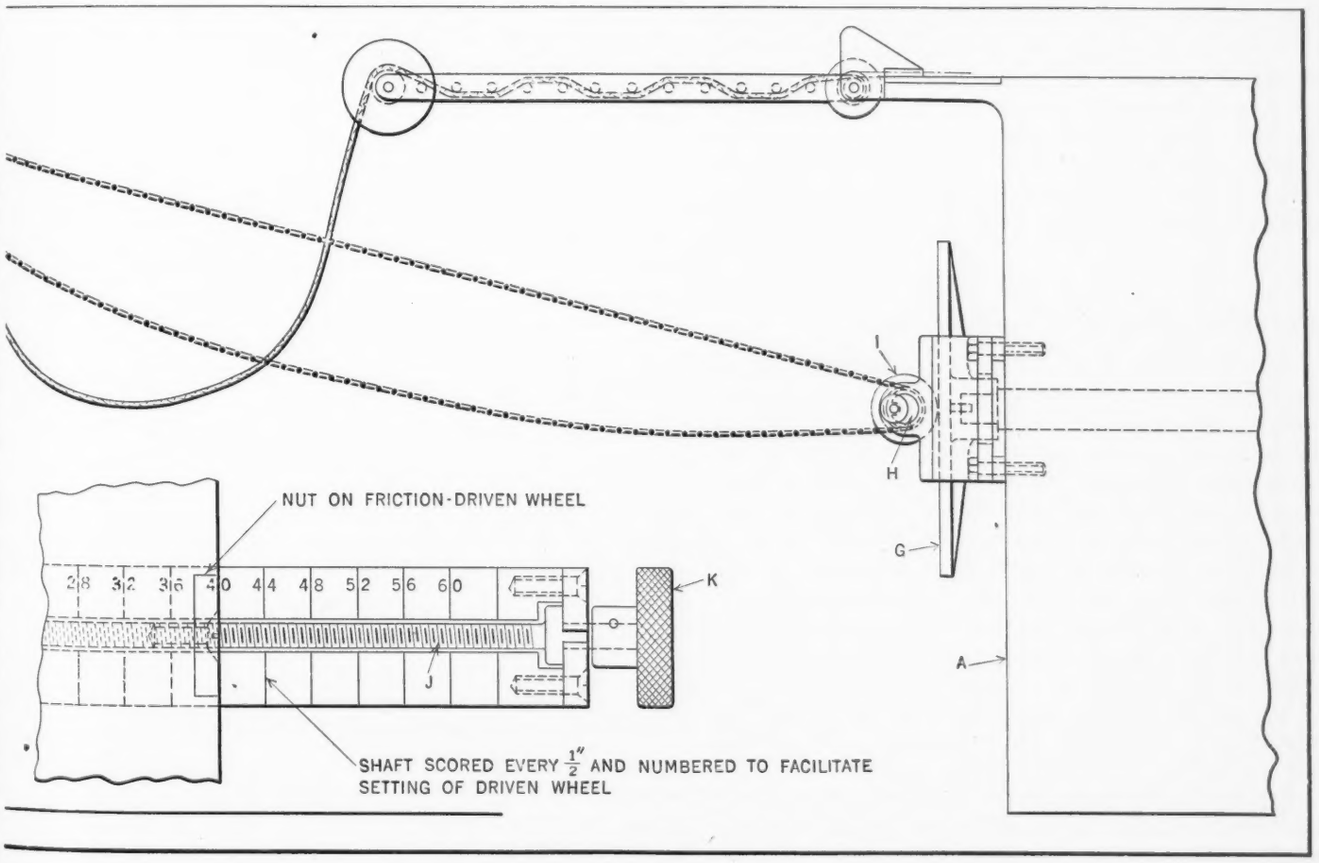
The spring Fair at Leipzig, Germany, is reported to have been unusually well attended. Twenty-four countries were represented, with 7562 exhibits in all classes of industry and art. There were 150,000 visitors, of whom 16,000 were from abroad. It is stated that sales of machinery and tools actually concluded at the Fair were 40 per cent above those of last year.

## Summer Meeting of A. S. M. E. in Denver

The semi-annual meeting of the American Society of Mechanical Engineers will be held in Denver, Colo., June 25 to 28, with headquarters at the Cosmopolitan Hotel. Papers will be presented on engineering subjects of particular interest to the region in which the meeting is to be held. A series of talks, with motion pictures, giving a complete story of the remarkable work at Boulder Dam will be included. Other subjects to be dealt with are heat engineering and air conditioning, the burning of pulverized lignite, and petroleum coke.

The management division will concentrate on the subject of the decentralization of industry, with particular reference to its effects in the western part of the country. Industrial management under the NRA will also be discussed. A description of a unique example of cooperative manufacturing will form the subject of one of the sessions. Papers on high-speed light-weight railroad trains will be presented by engineers of the Burlington and the Union Pacific Lines. There is a possibility that the high-speed trains recently developed for these lines will be in Denver and available for inspection during the meeting.

Several excursions are planned to points of engineering interest, as well as to places noted for their scenic beauty.


I
H
G
K
A
J
NUT ON FRICTION-DRIVEN WHEEL
2 8 3 2 3 6 4 0 4 4 4 8 5 2 5 6 6 0
SHAFT SCORED EVERY 1/2" AND NUMBERED TO FACILITATE SETTING OF DRIVEN WHEEL

Enlarged View Shows Speed-adjusting Screw Set in Groove in Shaft H

# Engineering News Flashes

## *The World Over*

### Light Metal Aids High Flying

In building the stratosphere balloon, by which the upper regions of the atmosphere have been explored, the magnesium alloy Dowmetal was chosen as the only material that would have, on the one hand, the needed strength, and, on the other, the required lightness. Every pound saved in the weight of the gondola meant that it could rise 15 feet higher. The exterior shell of the "air-globe" was made of rolled Dowmetal plates, welded together. Shelves were made of rolled sheets, and the hatches of cast Dowmetal. Extruded Dowmetal posts supported the shelves, so that practically all common forms of metal fabrication were used in the construction.

### More Oil Engines for Ships

In 1933, only 116 ocean-going steamers were launched in the world, with a total tonnage of 142,000. The same year, 195 oil-engine-driven ships were launched, with a total tonnage of 337,000. The motor ship has gained steadily over the steamship in new construction for a number of years, and several liners over 25,000 tons in size are now Diesel-engine driven. It is of interest to note the trend toward the internal combustion engine in all forms of transportation.

### Portable Wireless Telephone

At the World Power Conference held in Stockholm last year, a striking novelty was introduced which enabled audiences at the meetings to listen to addresses while moving about, without being disturbed by conversation between bystanders. This new device, called the conference telephone, is constructed by the L. M. Ericsson Telephone Co. It is a portable wireless receiver set of tiny dimensions, consisting of a coil antenna, placed around the shoulder, a small receiver box fixed in the buttonhole or placed in a pocket, and a head receiver. The transmitter antenna is mounted around the walls of the conference room, so that the bearer of the receiver set may stand or move about anywhere in the room while listening to the address.

Another great advantage is the possibility of interpreting a lecture in different languages simultaneously. While the principal speaker is talking, interpreters sit in an adjoining room and their interpretations are sent over different wave lengths for different languages. The listener chooses the receiver set tuned for the wave length of the language which he prefers to hear. It is said that this revolutionizing innovation was enthusiastically received by the nine hundred members of the Power Conference.

### A New System of Factory Heating

In the times of the Romans, houses were heated by means of flue systems running under the floors through which hot air was passed. Our civilization has developed many entirely different means of heating. It is of interest to note, however, that recently a new system, similar to the old Roman type, which is known as the Deriaz system of floor heating, has gained ground in Europe.

The particular aim of this system is an even distribution of heat. The heat is conveyed through pipes laid under the floor and is transmitted to the flooring by means of strips of metal made of good heat-transmitting materials, so designed that the heat they carry reaches the upper surfaces of the floor in equal quantities. By means of these strips of metal, known as "diffusers," it is possible to heat a large area, using only a few pipes and a moderate temperature at the floor. The pipes are laid in parallel, the joints being welded; there are no threaded joints or fittings to leak. Either steam or hot water may be used as the heating medium.

### Cause of Static in Motor-Car Radios

Static interference in motor-car radio reception led engineers of the Packard Motor Car Co. to make an extensive search for the cause. They discovered that static is produced by the flexing of the side walls of under-inflated tires; by loose fan belts; and by dragging brakes. The revolving tires and fan belts, under certain conditions, appear to act as generators of "static" electricity.

### Life of Knives Quintupled by Hard Facing

The application of wear-resisting material to grain-scraper knives has increased the life of these knives five times. According to *Oxy-Acetylene Tips*, these knives are 24 inches long and 8 inches wide and are used to scrape the ground grain from

steel rollers in grain mills. The continuous contact of the scraper blade with the steel roller causes an ordinary steel blade to wear down very rapidly, and hard-faced blades lasting five times as long as ordinary steel blades have proved a real economy.

## Gantry Crane Built Entirely by Welding

An arc-welded gantry crane, said to be the first of this type to be built entirely by welding, has been completed by the Shaw-Box Crane & Hoist Co., Inc., Muskegon, Mich. The complete crane weighs approximately 150 tons and has a boom 96 feet in length, carrying a lifting magnet or a clam-shell dipper. A few bolts were used for erection purposes, but the complete structure is essentially arc-welded steel construction. The welding was done by the shielded-arc process, using Lincoln Electric Co.'s equipment. The crane is now in operation in Muskegon, Mich.

## Largest Vulcanizing Hydraulic Press

What is claimed to be the largest hydraulic press designed for vulcanizing rubber belts and mats was recently installed at the works of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., in Great Britain. This is a 10,000-ton press with heated platens having a working surface of 31 by 8 1/2 feet. The entire machine is constructed from steel castings and forgings, and weighs 260 tons. It was built by Siempelkamp & Co., of Krefeld, Germany.

## Aircraft Inventors are Active

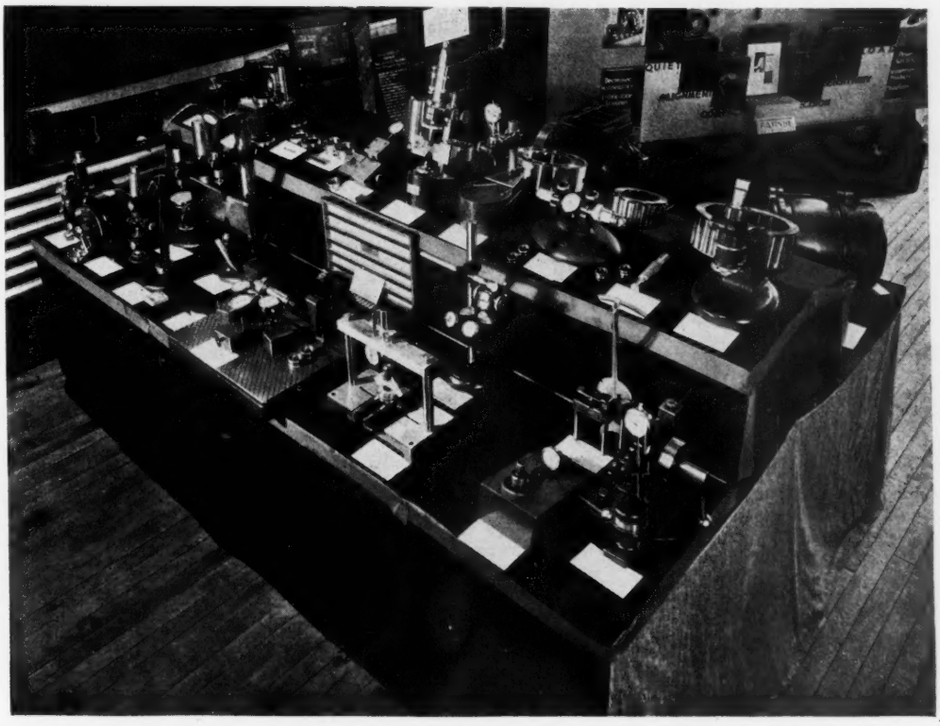
A recent report of the Manufacturers' Aircraft Association calls attention to the fact that the number of inventions pertaining to aircraft, aircraft engines, and accessories doubled in 1933. The members of this Association are pooling patents in a manner somewhat similar to the practice followed by the automobile manufacturers, and now jointly own or control over six hundred aircraft patents.

## Sowing Grain by Airplane

An unusual application of airplanes is mentioned in the *Economic Review of the Soviet Union.* Grain is being sown in the Soviet Union by means of airplanes; an area of 370,000 acres will be sown in that way this spring, as compared with 180,000 acres last year. Over one hundred airplanes will be utilized for this purpose. How much more sensible a use for airplanes—to sow seed rather than bombs!

## High-Speed Air Compressors

Until the last few years, air compressors have been driven almost entirely by means of belts and gears at speeds of from 100 to 500 revolutions per minute. Today, however, reciprocating compressors are being operated successfully at from two to three times this speed, according to J. W. Baugher, Jr., of the Westinghouse Electric & Mfg. Co. Electric refrigeration and, later, air-conditioning requirements have contributed largely to these changes.



Group of Twenty-three Types of Gages and Measuring Instruments Used by the Fafnir Bearing Co. for Checking the Dimensions of Bearings. These Gages and Inspection Tools are a Small Group of Several Thousand Similar Devices in Daily Use in the Fafnir Plant. The Checking of the Testing Equipment and the Inspection of the Product Consume between 20 and 25 Per Cent of the Direct Labor Cost in the Manufacture of Every Ball Bearing

# Centralizing Machine Controls with Flexible Shafts

**How the Control of Machines, Instruments, and Mechanisms is Placed at the Finger Tips of the Operator through the Use of Flexible Shafts**

By FREEMAN C. DUSTON

CENTRALIZED control, or the grouping of all the operating levers of a machine within convenient reach of the operator, has been an outstanding feature of machine developments in the last few years. Shafts, universal joints, links, rods, bellcranks, gears, racks, sprockets, chains, and electrically operated devices have been used extensively in bringing the controls for various mechanisms or units of a machine to a central position.

Many of these control systems seem unnecessarily complicated and expensive. Nevertheless, the convenient grouping of controls now found on all modern machines has become an indispensable feature. In the automotive and radio fields, the remote control of various instruments and mechanisms has been achieved effectively by means of flexible shafts, which eliminate complicated arrangements of links, rods, gears, etc., such as would otherwise be required.

Several examples of remote control by means of flexible shafts are given in the following paragraphs, with the object of bringing to the attention of engineers and designers the possibilities of this comparatively simple means of obtaining remote or centralized control for machines and mechanisms.

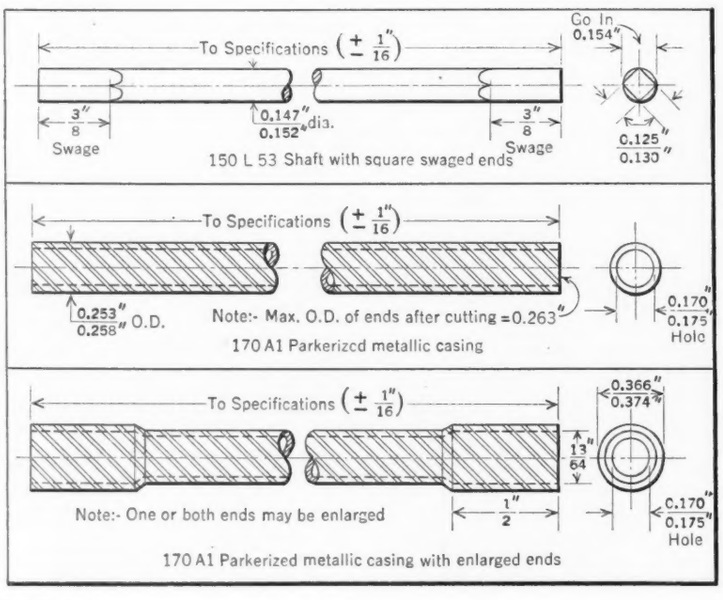
Approximately 95 per cent of the radio receivers used in automobiles have remote controls of the flexible shaft type. For this particular service, The S. S. White Dental Mfg. Co., New York City, developed a special flexible shaft and casing, the details of which are shown in the upper view of the illustration. This flexible shaft is known as 150 L 53. The first number, 150, designates the diameter of the shaft, which is 0.150 inch; the letter "L" shows that the lay of the shaft is left-hand; and the second number, 53, identifies the characteristics of the shaft. A new feature of the casing for this shaft is the enlarged end, which has an outside diameter of 3/8 inch, although the body of the casing is only 1/4 inch in diameter.

Torsional deflection, sometimes called backlash, is held to within 0.35 degree per foot per ounce inch load, when this specially wound shaft is rotated in either direction. The recommended minimum radius of curvature is 4 inches. A larger radius is, of course, preferable. The square swaged end illustrated is the recognized standard method of finishing the shafts. It is the correct method of securing a shaft preparatory to cutting it to length, as it prevents any possibility of the shaft unwinding.

Easy calibration of the control unit and radio condenser is obtained when the shaft is to be held by a set-screw, by having the ends swaged to an eight-sided form. The shafts can be obtained with intermediate swaged sections located at one or more points on a shaft of any cut length. These shafts can then be cut off at any of the swaged sections to adjust the length to suit requirements.

The Parkerized metallic casing shown in the two lower views of the illustration was especially developed for the remote control of automobile radios. This casing is rugged but small, and has a rust-resistant finish.

A unique feature of the flexible shaft as a means for obtaining remote control is the facility with which it can be arranged to




Details of Flexible Shaft and Metallic Casing Developed for Remote Control of Radio Receivers Installed in Automobiles

transmit both rotary and linear, or push-pull, movements. The combination choke and needle valve adjustment controlled by the single button on the cowl of the last four-cylinder Ford car, for example, was made possible by arranging the flexible shaft connection for linear and rotary movements.

The rapidly increasing use of flexible shafts for remote control purposes on automobiles is doubtless due largely to its success in solving the radio remote control problem. At least one automobile manufacturer has eliminated a source of annoyance to many automobile owners by making it possible to open and close the oil drain plug in the crankcase by manipulating a handle conveniently placed near the filling funnel. In this case a flexible shaft connected to the valve is brought up through the splash pan to the control handle.

### *Special Shaft Developed to Withstand High Temperatures*

Designers and engineers in many different fields are rapidly becoming acquainted with the advantages of flexible shafts for operating or controlling mechanisms in inaccessible places or for placing one or a number of controls in a group to facilitate their manipulation. The manufacturers of domestic gas ranges, for instance, have made their products more convenient to operate, and at the same time, greatly improved the appearance by locating the oven temperature control dial on the front panel. Thus, the control is placed in line with the handles controlling the various burners instead of in the old position at the side of the oven.

For this application, the S. S. White Co. developed a special flexible shaft designed to make one right-angle bend, to withstand the high temperatures encountered, and at the same time, have the flexibility required without torsional or angular deflection. This is only one of many applications in which the engineers of the flexible shaft manufacturer have developed a special shaft for a specific purpose.

### *Flexible Shaft Made of Phosphor-Bronze for Special Purpose*

Another example of special flexible shaft design is found in the new type controls for washstand drain stops or waste pipe valves. This arrangement permits the valve or stop control knob to be placed in the most convenient position. For this application, the shaft is made of phosphor-bronze and operates in a solid brass tube. No rotary motion is required, and the valve is operated by a simple push-pull movement.

Flexible shafts are being used in some cases to operate indicators that show the positions of movable parts located at some inaccessible place in a machine. In one application of this kind, the exact settings and relative positions of several cams on a bottle-filling machine are shown by graduated drums or cylinders placed end to end on a shaft. Each scale is operated by a flexible shaft leading to its individual cam.

The operation of electrical switches from remote points where the space is too small to permit running electric wires to a switch at the desired point of control is still another application of flexible shafting which has solved several troublesome problems. Remote control of switches in this manner makes it possible to avoid running wires through chambers or spaces where current-carrying wires might constitute a fire hazard or where the insulation required to prevent short circuits because of heat or contact with liquids would be too expensive. In some cases, flexible shafts are used without protective casings. When comparatively long lengths are used in this way, bearings may be provided at various points to support the shaft and prevent it from coiling.

Flexible shafts not only provide a convenient means of transmitting rotary or linear motion from one point to another around corners or intervening parts of a machine, where it would be difficult or too expensive to employ other means, but they also possess certain advantages over other equipment used for this purpose. For instance, either end or both ends of the flexible shaft can be mounted on parts that are movable or adjustable within certain limits. The ease with which flexible shafts can be installed or removed when machines are being adjusted or repaired is also a feature to be considered.

### *Remote Control of Many Mechanisms Made Possible by Simple Installations*

While flexible shafts have long been used as drives for portable tools and other power transmission applications, it is only recently that designers and engineers outside the automotive and radio fields have begun to realize their possibilities as a means of obtaining simplified remote control for instruments and mechanisms. However, judging from the success of recent applications, flexible shafts are likely soon to attain as important a position in the field of remote or centralized control as they now enjoy in their particular field of power transmission equipment.

This comparatively new application of flexible shafting is rapidly being extended, and designers and engineers in general will find it advantageous to be "flexible-shaft conscious" when solving problems in machine and mechanism control. It is well to bear in mind that flexible shafts are made in a great variety of types and sizes and that they must be selected to suit the particular application. In most cases, the engineering department of the flexible shaft manufacturer is able to specify the most suitable type when the requirements are given, or to work out a new design when necessary.

* * *

Asked how he was finding business, one manufacturer said: "By going after it."

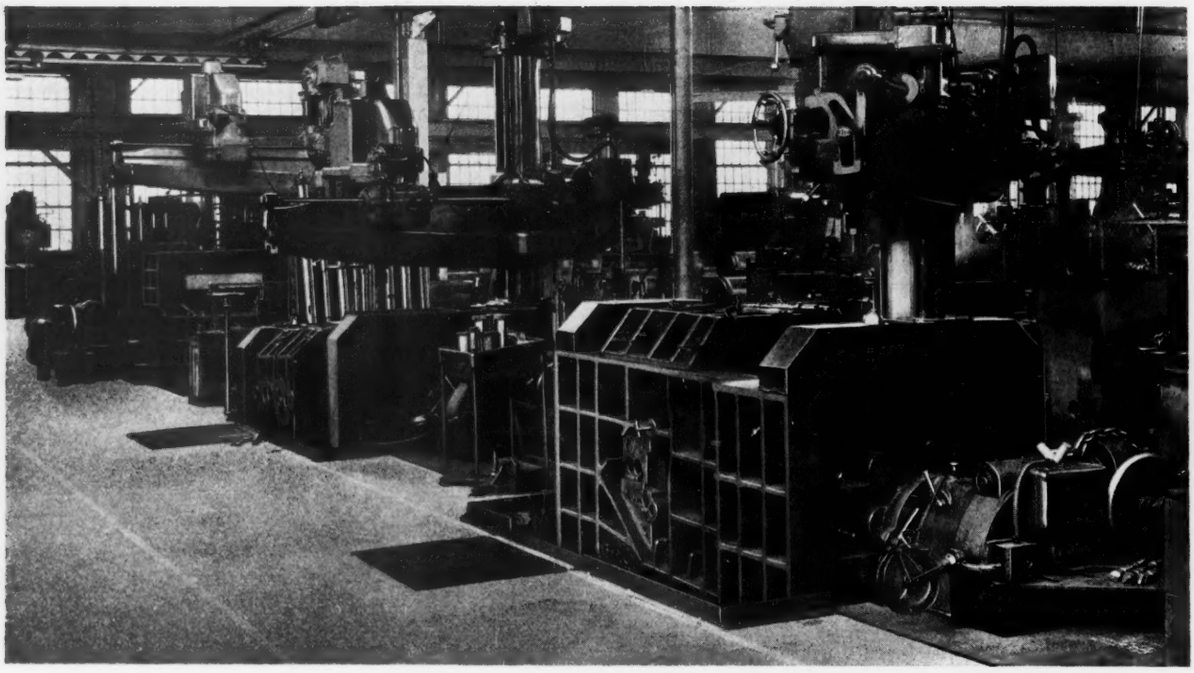


*Fig. 1. Battery of Three Radial Drills Equipped with Motor-indexed Jigs in which All of the Boring Operations Required on Heavy Milling Machine Columns are Completed*

# Precision Indexing Jigs for Boring, Drilling, and Tapping Heavy Work

**Heavy Machine Members are Bored, Drilled, and Tapped Rapidly and Accurately in Jigs with Special Indexing Features**

By D. STRAUCHEN, Superintendent
The Cincinnati Milling Machine Co.
Cincinnati, Ohio

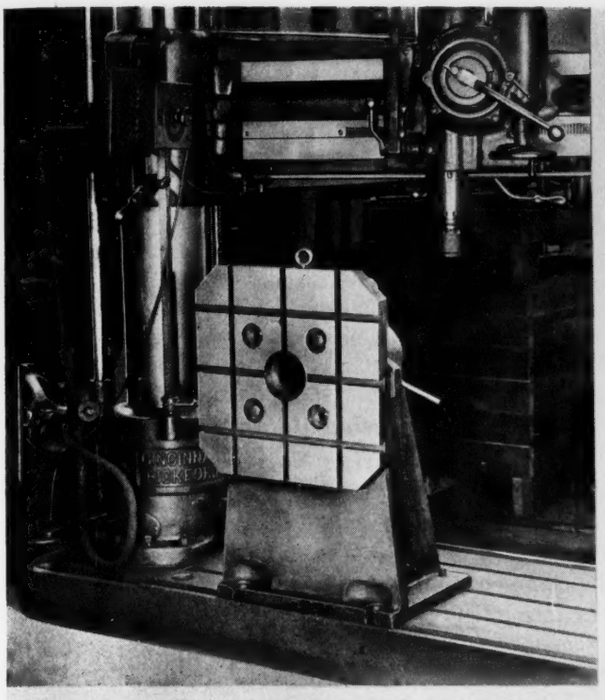
THE machining of heavy castings usually presents interesting handling problems, especially when a large number of holes must be drilled, bored, tapped, or otherwise machined on two or more sides. Until comparatively recent times, overhead cranes and man power were the means generally employed to turn over large castings and relocate them for drilling and boring on the various sides requiring such operations. The Cincinnati Milling Machine Co. and The Cincinnati Grinders, Incorporated, have developed rather unique methods for handling work of this character. The results achieved have been interchangeability of parts and a high degree of accuracy of the product.

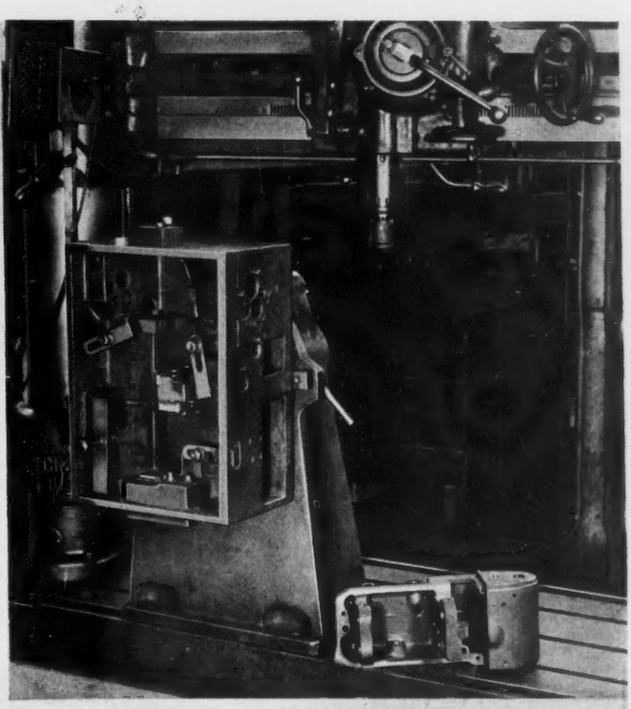
The introduction of the indexing head shown in Fig. 2 was the first move in developing improved methods for handling heavy work requiring precision boring, drilling, tapping, and similar operations on more than one side. The equipment shown in Fig. 2 consists essentially of an index-plate or table mounted on a horizontal shaft having a bearing in a cast-iron base clamped to the bed of a drill press. The work, attached directly to the index-plate of this equipment, can be indexed to any angle. Thus any surface can be brought into the normal position for drilling or boring. Templets of suitable design were attached to the index-plate at each position. The tools used for this work were much the same as those previously employed. The main advantage gained by using this equipment was the ability to index quickly to any desired position.

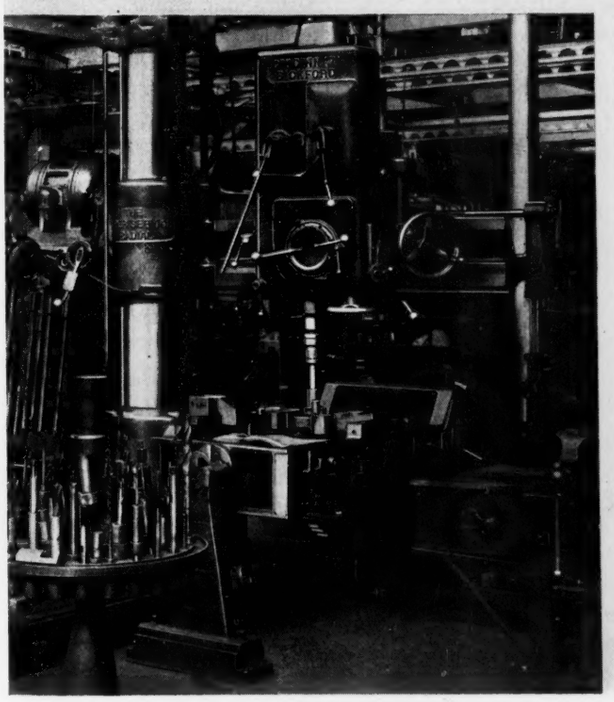
The next improvement was the attaching of a special jig to the faceplate of the index-head, as shown in Fig. 3. The work can be located in this jig very quickly. Using this method for such work as gear-boxes, etc., it was found that not only was

*Fig. 2. Plain Indexing Head with Face-plate Attached, which was the Forerunner of the Larger Jigs Shown in the Succeeding Illustrations*

*Fig. 3. Index-head Equipped with Jig for Performing Drilling, Boring, Reaming, and Tapping Operations on Feed-box Shown on Machine Base*







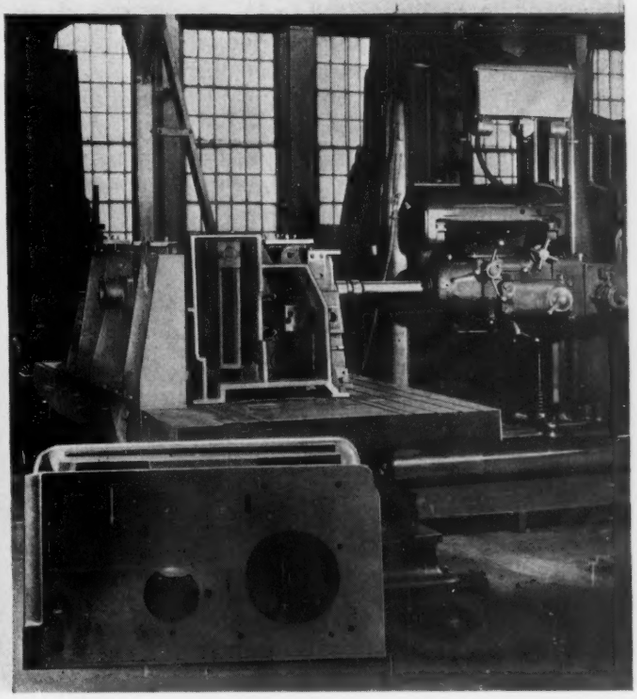


*Fig. 4. Jig Mounted on the Index-head and Tailstock and the Tools in the Revolving Tool-stand are Employed in Machining Milling Machine Saddles*

*Fig. 5. Special Boring Machine with Jig Used for Performing Boring and Drilling Operations on the Machine Bed Shown in Foreground of Illustration*

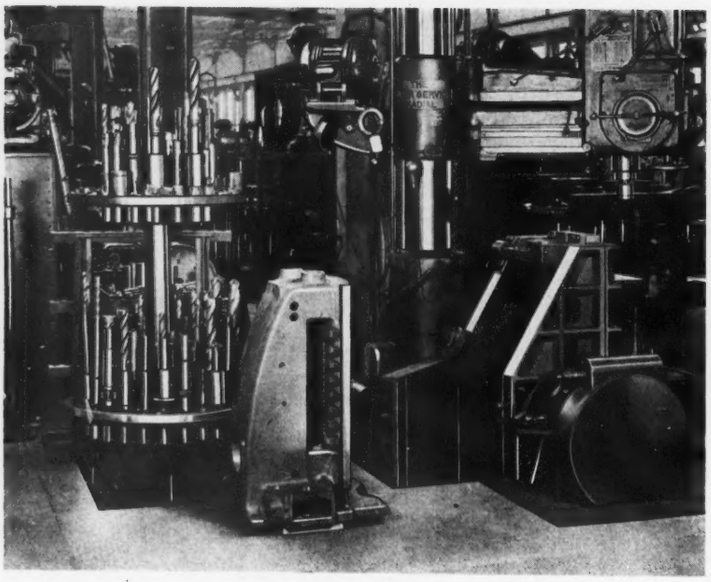


*Fig. 6. Jig Mounted on Worm-driven Index-head, and Revolving Stand with Tools Used for First Operation on Milling Machine Knee in the Foreground*

there a great saving in time, but much better results were obtained in maintaining gear center distances and hole sizes within close limits. However, the tools underwent a change, a complete set of special tools being required. Special piloted boring and facing bars and setting gages and other necessary equipment made this a complete and efficient set-up.

The next step was the application of the indexing principle to heavier castings, such as a milling machine saddle, as illustrated in Fig. 4. In this case, a tailstock is used to support the outer end of the fixture. The casting is lowered into the jig by a crane, after which positioning of the work for machining the different sides is accomplished by simply indexing the jig. In the case of the jig for the milling machine knee shown in Fig. 6, indexing is done through a worm and worm-wheel.

Accuracy and the necessity for duplication require that these jigs and tools be as nearly perfect as it is humanly possible to make them. The knee casting is unusually heavy and requires two operations, both of which are performed in indexing jigs. The jig used in the second operation is shown in Fig. 7. Approximately 120 holes are bored, reamed, or tapped in this knee casting. These holes are on all sides of the casting. In the first operation, all holes in one plane of revolution are machined, while those in the other plane are machined in the second operation.

The requirements of the mechanism assembled in the finished knee are such that many of the holes must be bored with the utmost accuracy as regards size and direction. Some of the holes are for spur gear shafts and some for bevel gear centers. The tools used are all held in the revolving stand, each tool being arranged according to the order in which it is used. This aids the operator in selecting the proper tool, eliminates errors, and reduces the time required for performing the various operations. It is interesting to note that no work machined with this equipment has been spoiled.

### *Incorporating Motor Drive for Indexing Movement*

After a thorough study of the set-up shown in Fig. 7, one might well think that the end of the development had been reached. However, a further advance in the application of indexing jigs to heavy precision work is illustrated in Fig. 8. This jig embodies all the previously mentioned features, together with some new and unusual ones. It is used in performing the boring operations on a milling machine column. This is obviously an unusually large casting for a box type jig. The column casting is located in the jig from the face for the knee bearing, which is machined in a previous operation.

This jig, like those previously described, is of the indexing type with head and tailstock supports, but a motor mounted on the head provides power for the rotating or indexing movements. A power-

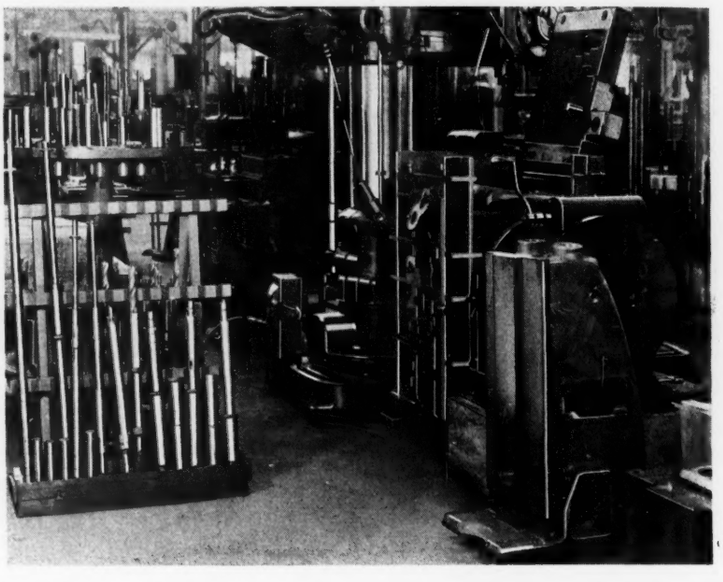


*Fig. 7. Jig and Tools Used for Second Operation on Milling Machine Knee, Following the Operation Performed on Machine Shown in Fig. 6*

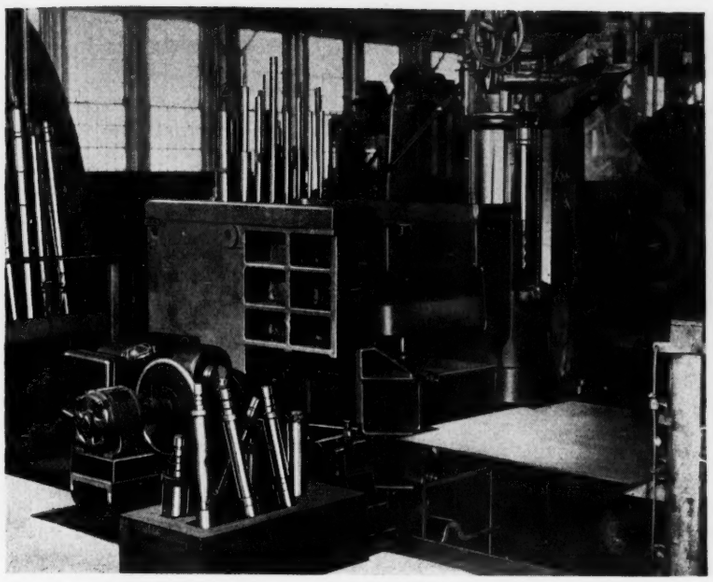


*Fig. 8. Approximately Forty Holes are Machined in the Milling Machine Column Held in the Motor-indexed Jig Shown*

driven elevator is arranged at each end of the jig to enable the operator to descend into the pit underneath the jig for the purpose of making cutter adjustments or to reach any position desired along the face of the jig when it is indexed to the vertical position.

The arrangement of tools is somewhat different for this job, due to the great weight of some of the boring-bars. The large bars are held in a rack in a vertical position to facilitate handling with a specially arranged overhead crane. An adapter, which is a duplicate of the quick-change chuck on the machine spindle, is provided on the crane lift. An eyebolt, slipped over the quick-change collet on the bar, enables the bar to be lifted out of the tool rack and lowered into the proper location in the jig.

All boring-bars have hardened and ground bearing surfaces running in cast-iron bearings that have been internally ground. They are equipped with the latest type high-speed steel or Carboloy-tipped cutters. Ground high-speed steel taps are also used throughout to insure proper fits in all tapped holes. The best gaging equipment obtainable is included in this equipment to insure proper fits and alignments for all the bored and tapped holes.

The boring, facing, drilling, reaming, and tapping operations on the milling machine column shown in the jig in Fig. 8, are all accomplished in three operations, requiring three motor-indexed jigs of similar construction. All three jigs are used on machines arranged in the order in which the boring and drilling operations are performed, as shown in Fig. 1. The machine shown in Fig. 8, which performs the first operation, is shown at the left of the line in Fig. 1. The first operation consists of rough-boring the main holes and drilling and tapping the holes in the bottom of the column. The main holes include the spindle and main driveshaft holes. These are rough-bored, after which the work is taken from the jigs to cool before finish-boring. This is done to insure perfect alignment of the bores when the machine work is finally completed and the casting is ready for assembling. Approximately forty holes are machined in this operation, including back and forward facing and tapping.

The second operation is performed in a similar jig, the work being revolved or indexed in a different plane for finishing the holes rough-bored in the first operation and for machining additional holes. All important holes are finish-bored and faced in this operation, the feeds used being carefully selected to insure holes of accurate size, alignment, and concentricity. Back and forward facing and tapping operations are performed, together with finish-boring operations of high precision.

The third operation is performed in a jig similar to those used for the two preceding operations. The

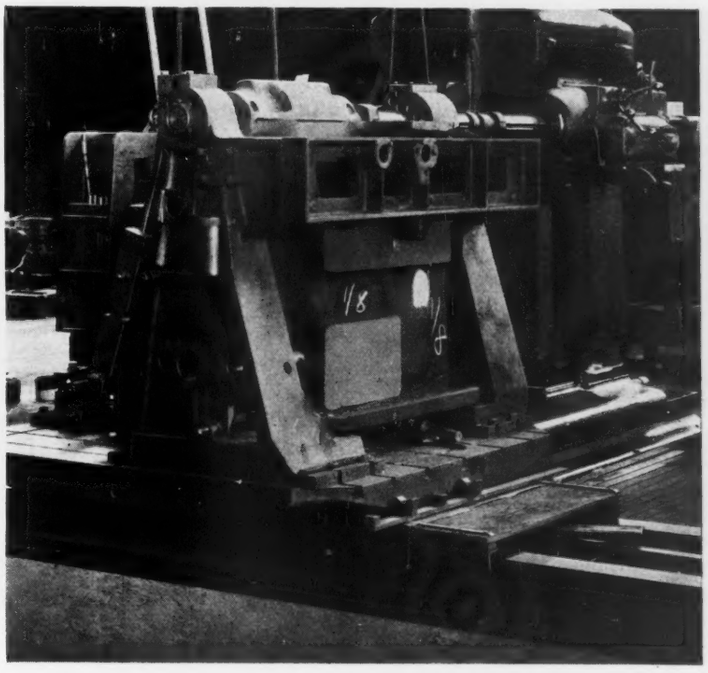


*Fig. 9. The Machine Shown in Fig. 5 is Here Illustrated with a Centerless Grinder Bed Mounted in Jig Ready for Boring Operations*

revolving or indexing movements are made in the same plane as that for the second operation. The work done in the third operation is not so important as that performed in the first and second operations. It includes drilling and reaming or tapping about 125 holes.

### *Special Machine for Radial Drilling and Horizontal Boring and Indexing*

In Fig. 5 is shown a horizontal boring machine which might be termed a horizontal radial boring machine. This is a completely self-contained machine with all electrical controls conveniently located. The column has power feed and rapid traverse movements along the bed. The table can be moved in the same way in a plane parallel to that of the plane in which the column travels, but at right angles with the axis of the boring-bar. The spindle carrier moves in a vertical plane between the column housings, and is mounted on trunnions that permit it to be swung in an arc, much the same as the arm of a radial drill. This allows the spindle considerable adjustment. Clamping is done by air with the same control used to swing the arm.

The table is of the revolving type and can be indexed to any desired position. On work within its capacity, this machine has almost unlimited possibilities. It has the speed of a radial machine for drilling, reaming, or tapping, and possesses the desirable features found in a horizontal boring machine of the type built for precision work. In addition, it has an indexing table. Thus it is possible to handle on this machine work that would ordinarily require the use of several machines.

The illustration shows a bed casting located in a jig on the index table. The bed casting is lowered into the jig by means of an overhead crane. All sides of the casting can be presented to the drills and boring-bars, as the table on which the work is held can be indexed through any angle. The spindle slide can be indexed vertically and the position of the spindle can also be changed by swinging the spindle arm on its trunnion bearings. The table slide can also be indexed horizontally. These adjustments permit locating the work in almost any position within the range of the machine.

This casting has approximately ninety holes, ranging from 19/64 inch to 8 1/2 inches in diameter, which are required to be drilled, reamed, bored, or tapped. As usual in this type of work, a high degree of accuracy must be maintained.

Another operation performed on a machine of the same type is illustrated in Fig. 9. In this case, the work consists of boring operations on a bed for a centerless grinder. The indexing table permits all sides of the casting to be presented to the boring and tapping tools. There are sixty-five tapped and reamed holes ranging from 1/4 to 1 inch in diameter, and two 4-inch holes which are rough- and finish-bored to size. These holes are faced inside and out. Owing to the intricate shape of the casting and the necessity for having extremely clean and accurate holes, 3/8 inch of metal is left on the castings for machining purposes. This, of course, necessitates the taking of rather heavy cuts in the rough-boring operation, showing that the machine is capable of handling heavy-duty work, as well as being flexible and sensitive in operation where high precision is required.

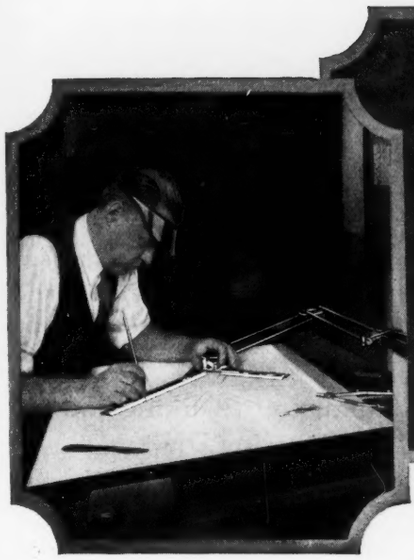
# Recent Hard-Facing Applications

The application of hard-facing materials to softer metals in order to provide extremely hard cutting edges or wear-resistant surfaces has many well known advantages, especially in reconditioning worn tools and parts. Within the past year, however, industry in general has shown an ever-increasing interest in the use of hard-facing materials on new parts. A review of past-year developments in the application of hard-surfacing materials, such as Haynes Stellite, Hascrome, and Haystellite, to new parts and products recently appeared in *Oxy-Acetylene Tips*.

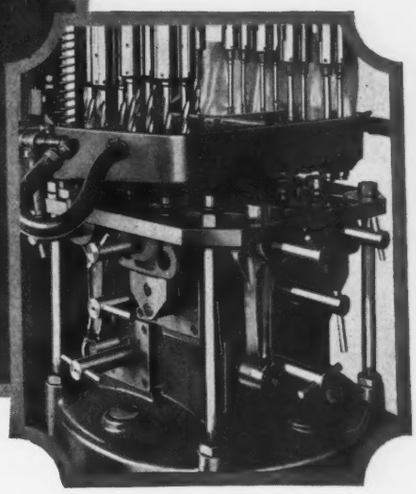
Among the applications mentioned is the use of Haynes Stellite on gate and globe valves for high-pressure and high-temperature steam service. Facings of this material are applied to the seat rings and disks by means of the oxy-acetylene blow-pipe. The surfaces thus built up combine excellent stainless qualities with exceptional hardness and resistance to wear and scoring.

Another development that has gained wide recognition among automotive engineers is the hard-facing of exhaust valves and valve seats. Three well-known bus and truck manufacturers have standardized on hard-faced seats for all their standard motor blocks. Bus engine valve seats hard-faced with Haynes Stellite did not require regrinding or refinishing after the bus had been operated 150,000 miles. The life of an ordinary cast-iron seat is conservatively estimated at 10,000 miles between grinds. The automobile and aircraft industries have also been very successful in applying hard surfacing to dies, cams, tail skids, tire chains, and many other parts.

The use of hard facing has increased enormously during the past year in the excavating, dredging, and quarrying field. Where abrasion is intensified by heat, as in the iron, steel, coke, and gas industries, hard-facing has proved very valuable, especially for water-cooled pokers, coke pusher shoes, hot shearing knives, hot forming and trimming dies, carbon scrapers, tap hole augers, and mill guides.



# Design of Tools and Fixtures

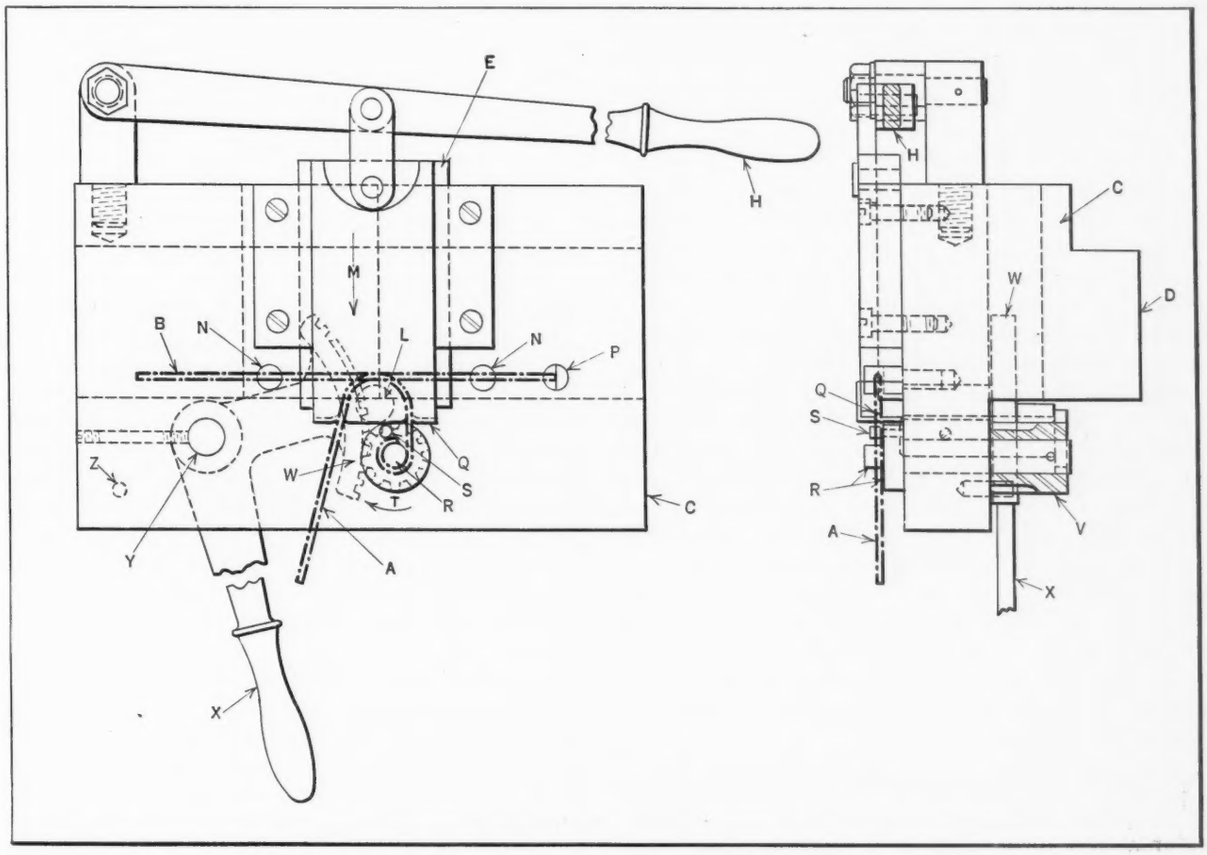


## Wire-Forming Fixture Operated by Hand-Levers

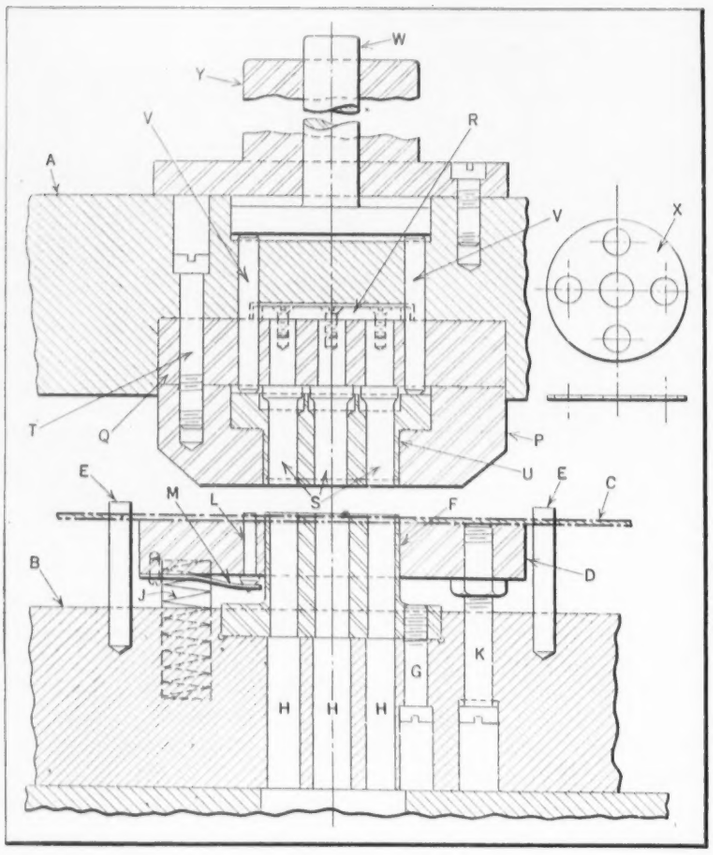
By F. H. MAYOH, Springfield, Mass.

It is often feasible to mount hand-operated wire-forming equipment on a cast-iron block that can be held in a vise. This was done in the case of the fixture shown in the accompanying illustration. The formed part is shown by the heavy dot-and-dash lines at *A*, while at *B* is shown the straight wire rod before forming. The tongue *D* of the cast-iron block *C* is proportioned to suit the vise jaws and to insure that all the operative mechanism will clear the vise.

On top of the block is mounted the slide *E*, oper-




The Straight Wire Piece Indicated at B is Bent to the Shape Shown at A by Simple Movements Applied to Hand-levers H and X




Die for Blanking and Piercing Disk X at One Stroke

ated by the hand-lever *H*. There is a formed arbor at *L* around which the wire is bent by the action of slide *E* when it is advanced in the direction indicated by arrow *M*, the wire *B* being located by the operator's left hand on the two pins *N* and against the stop-pin at *P*. Slide *E* is operated with the right hand through the medium of the lever *H* when the wire is clamped between the shallow groove *Q* in the end of the slide and the arbor *L*. This gives the wire a hair-pin shape.

Mounted in block *C* is a revolvable arbor *R* with a pin *S*. This arbor is set so that pin *S* will come to the right of the wire after the wire is bent to the hair-pin shape and its end lifted over the pin. Following this, the arbor *R* is revolved in the direction indicated by arrow *T*, through lever *X*, until pin *S* assumes the position indicated in the illustration. The loop at the end of the wire is now completely formed. A pinion *V* is pinned to the revolving arbor *R* and meshes with a segment gear at *W*, which is an integral part of hand-lever *X*. At *Y* is the stud on which the segment gear and lever *X* are pivoted.

After completing the bending of the wire, slide *E* is returned to its starting point, the work is picked off the arbor, and lever *X* is pushed to the left until it comes against stop-pin *Z*. In this position, pin *S* is in the correct radial location to receive the formed wire after the first bend is made, except that there is a slight curvature where the wire strikes the pin. This makes it necessary to spring the wire by hand over the pin *S*. In performing the bending operations, the operator pulls both levers toward each other, as in a hand shearing action, lever *H* being operated first. This operation is performed naturally and is less fatiguing than it would be if the lever movements were in different directions.

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## Combination Blanking and Piercing Die

By F. SCRIBER

The part shown at *X* in the accompanying illustration is punched out of the strip stock indicated at *C* in the cross-section view of the die. The stock is fed from right to left over a circular plate *D*, the entire structure being circular except for the castings *A* and *B*. Four pins *E* serve to guide the stock sidewise. Referring to the lower section, part *F* constitutes the punch for blanking out the work *X*, as well as the die member for piercing the five small holes. This part is held by three screws *G* in a recess in the die-bed through which pass clearance holes *H* for the slugs punched out from the work.

The circular plate *D* acts as a stripper for lifting the stock *C* off the punch after each operation, a series of springs *J* and limiting screws *K* being used to actuate this member. Pin *L*, acted upon by a flat spring *M*, locates the strip of stock endwise for blanking the first piece, and positions the stock for subsequent operations by coming in contact with the edge of the previously punched hole.

In the upper structure, the outer ring *P* acts as the die for punch *F*. Ring *Q* is a flat piece in which the five punches *S* are held. A large washer *R* and flat-head screws serve to hold the five small punches in place. Three screws *T* secure this unit in place. The sleeve *U* is free to move up and down slightly over the punches *S*. This sleeve makes contact with two pins *V*, which, in turn, are in contact with a knock-out plunger *W* in the shank *Y*. The knock-out plunger *W* passes through a hole in the ram of the press and receives a blow at the upper end of the ram stroke.

At each stroke of the press, the strip of stock *C* is forced over punch *F*. At the same time, small punches *S* pierce the holes and sleeve *U* is pushed upward. This action forces the part *X*, which is blanked out, into ring *P* over the punches, where it remains while the press ram is moved upward. At the top of the stroke, knock-out plunger *W* causes pins *V* to operate against sleeve *U*, thereby stripping blank *X* off punches *S* and forcing it out of

ring *P*. The press is tilted to allow the blank to fall out at the rear.

After the strip of stock *C* is forced off punch *F*, it is lifted clear of pin *L* and fed along until the right side of the blanked hole stops against pin *L*. This cycle of operations is repeated continuously as long as the press is in operation. Tools of this type have been found to operate accurately.

## Gage for Testing Alignment of Cylinder Bore with End Flange

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

The gage shown in Fig. 1 is used for testing the alignment of the bore of a cylinder with its end flange or base. The method of applying the gage to one of the bores of a two-cylinder block is illustrated in Fig. 2. Several different types of cylinders are bored in a Moline "Hole Hog," and this gage is used principally in setting up the boring machine.

The body *A* of the gage, Fig. 1, is made of Shelby tubing, ground to a slip fit in the reamed cylinder bore. The hardened and ground tool-steel strip *B* is the same length as the cylinder bore. When the gage is inserted in the bore, the spring-actuated plungers *E* force the gage against one side of the cylinder. Pin *F* is a rest pin only.

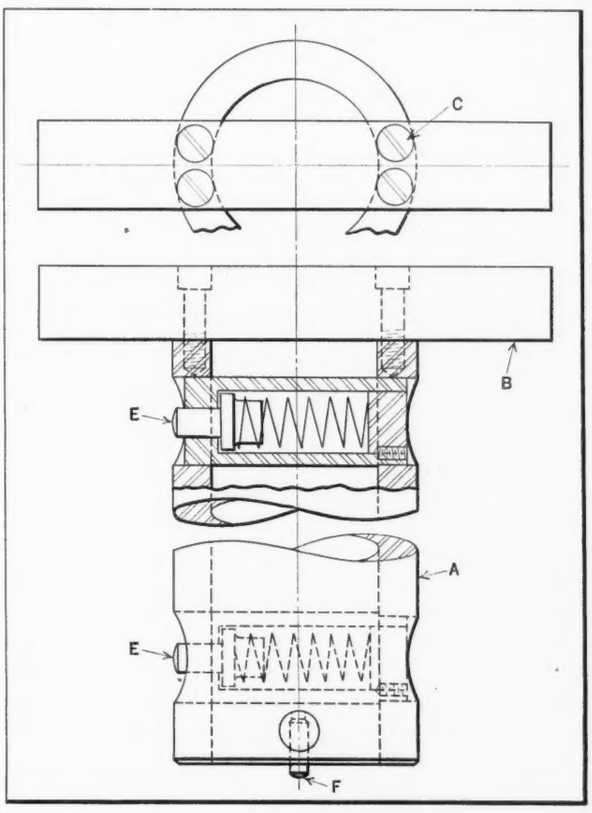



Fig. 1. Gage Used in Testing Alignment of Cylinder Bore with Flange

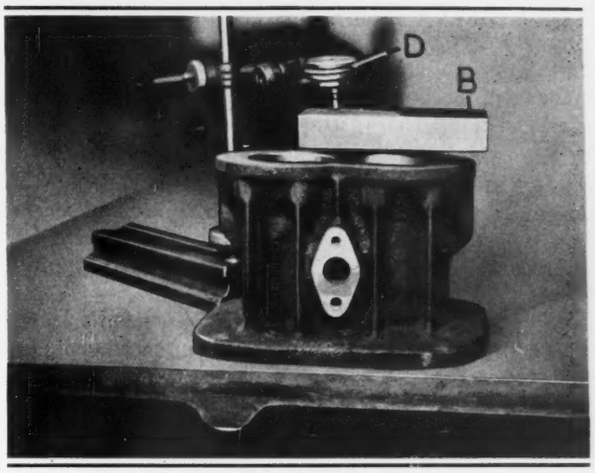



Fig. 2. Method of Using Gage Shown in Fig. 1

The cylinder is placed on a surface plate and the gage is inserted, as shown in Fig. 2. As the strip *B* is the same length as the cylinder bore, the exact amount that the bore is out of square can be read in thousandths of an inch on the dial indicator *D*.

After reaming in the Moline machine, the cylinder bores are honed. The reamed holes are practically all straight and uniform in diameter for their full length, but in case a cylinder bore is slightly tapered, the gage can still be used by making allowance when reading the dial indicator.

## Magazine Die for Press with Short Stroke

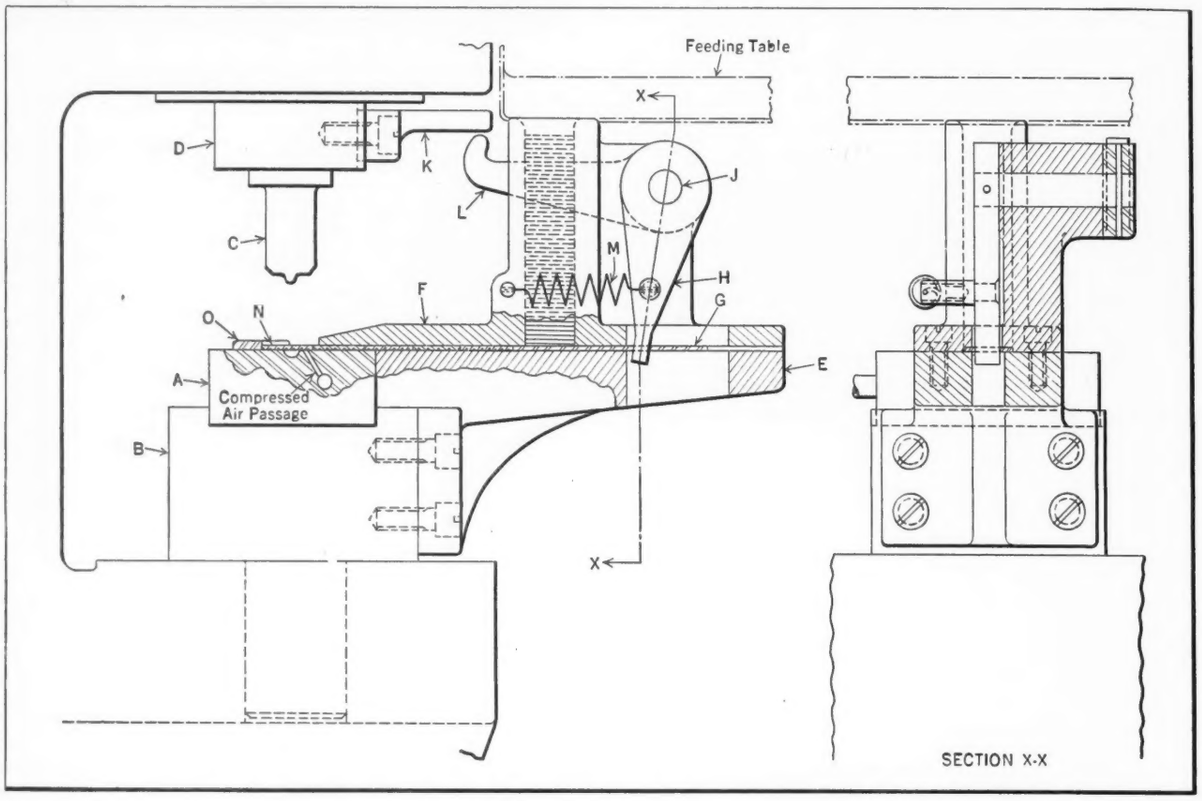
By J. E. FENNO, Belleville, N. J.

An important consideration in the design of magazine dies is to locate the receiving end of the magazine at a safe distance from the die and ram; otherwise, the operator's fingers will be endangered while inserting the blanks in the magazine. To obviate this condition, a press is usually selected that has a very long stroke, in order to impart a long stroke to the feed slide. In this way, the magazine can be located in a position to clear the ram by a safe margin. With the arrangement shown in the illustration, however, the receiving end of the magazine can be located at practically any distance from the ram, regardless of the stroke of the press.

The die *A* is fastened to the die shank *B* in the press bed. The blanks are formed in this die by the punch *C* in the punch shank *D* secured in the ram. The magazine consists of the lower bracket *E*, fastened to the die shank; the blank-holder *F*, secured to bracket *E*; and the reciprocating slide *G*, which is a free fit between members *E* and *F*. Slide *G* is actuated by the oscillating arm *H*, which engages an opening in the slide and is pinned to one end of the shaft *J*, mounted in a boss cast integral

with member *F*. On punch shank *D* is mounted a finger *K* which engages arm *L* pinned to shaft *J*. This arm, together with the coil spring *M*, serves to transmit the required oscillating movement to arm *H* for operating the slide.

The blank-holder is shown nearly filled with blanks and the punch is at the top of its stroke. As the ram descends, finger *K* rotates arms *L* and *H* in a counter-clockwise direction, causing arm *H* to move slide *G* toward the right until its left-hand end is past the stack of blanks. This allows the bottom blank in the stack to drop into position in front of the slide. In the meantime, the punch has reached the bottom of its stroke and has formed the blank *N*.




Magazine for Transferring Blanks Four Inches to Die when Press Stroke is Only 1 Inch

As the ram ascends, the tension in spring *M* causes the arm *H* to move slide *G* toward the left. Now as there are five blanks in front of the feed slide, the latter need only move a distance slightly greater than the length of a blank to deliver the next blank to the die. Just before this blank is fed on the die, a blast of compressed air, controlled automatically by the press ram, ejects the formed part. As the ram continues its upward stroke, the next blank is moved on the die and located accurately by the nest *O*. On the descent of the ram, this blank is formed, and at the same time, the feed slide returns for another blank.

It is evident that the distance that the magazine is located from the die depends solely upon the number of blanks carried in front of the feed slide.

## A Cadmium Plating Test that Shows Minimum Thickness

The value of cadmium coatings on metal parts for resisting corrosion depends upon the minimum thickness of the coating at any point. With this in mind, the Udylite Process Co., Detroit, Mich., has developed a stripping test for determining the minimum thickness of the coating rather than checking the average thickness, as is done in the stripping test in general use.

The new test involves the use of two acid solutions known as 5A and 5B. The cadmium coated part to be tested is immersed in the 5A solution for fifteen seconds, after which it is rinsed in water and inspected. If the entire surface is found to be covered with a brown film, the minimum thickness of the plate is at least 0.00005 inch.

The film is removed by rinsing the part in the 5B solution, after which the part is rinsed in water and then again immersed in the 5A solution for fifteen seconds. This procedure is repeated until the base metal stands out against the brown film on the plate, which is the "end point." If the end point is reached after, say, five fifteen-second immersions, the minimum thickness of the plate would be at least four times 0.00005 inch, or 0.0002 inch. The time required for testing plate of that thickness would be about 2 1/2 minutes.

# Titanium Alloys in the Automotive Industry

**How Titanium Additions Have Improved the Quality of Steel, Cast Iron, and Other Metals Employed for Industrial Purposes**

By GEORGE F. COMSTOCK, Metallurgist
The Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

AMONG the many materials used in the manufacture of automobiles, the element titanium, although it is not used as an individual metal for any of the parts of the car, is, nevertheless, effective in improving the properties of several of the metals and alloys used for automotive parts.

A striking feature of the newer cars is the excellence of the finish on the body surface. It might be thought that this is due solely to the lacquer or enamel used and the skill with which it is applied. However, the smoothness of the underlying steel surface contributes largely to the surface appearance. Any slight defect or blemish in the steel will show up after painting, and the automobile manufacturer, therefore, must select with care the quality of the sheets used for the external parts of his cars. The requirements for surface finish and ductility of auto-body stock steel sheets are, in fact, so severe that steel-makers must take every precaution to produce ingots of the highest quality.

For such steel, which is always low in carbon, it has been found advantageous to use titanium as a deoxidizer and scavenger for the steel in the ladle. Most manufacturers of auto-body sheet steel use ferro carbon-titanium for this purpose. Better yields of good steel from the ingot, less trouble in rolling, and higher production of finished sheets of the best quality result from this practice.

### *Titanium Alloy for Very Low Carbon Steel*

The increasingly severe requirements for high ductility in auto-body sheets, due to designs of modern cars and the desire to avoid welded seams as far as possible, have made it necessary in recent years to make this steel with lower and lower carbon content. Where a few years ago a carbon content of from 0.10 to 0.13 per cent was considered entirely satisfactory, it is now necessary to reduce it to half that value.

When the carbon content is so low, it has been found occasionally that the use of the ordinary ferro carbon-titanium as a scavenger may give trouble, because of the introduction of too much carbon with the titanium-alloy addition. To overcome this difficulty, a new kind of ferro carbon-titanium, with about half the normal carbon content, has been developed. It has been found possible to use this modified alloy in steels having less than 0.06 per cent of carbon.

In alloy steels for forgings, such as gears and axles, ferro carbon-titanium also has a field of usefulness as a deoxidizer and scavenger. These steels are nearly always thoroughly deoxidized, so as not to give off gases while solidifying in the mold, thus forming sound ingots of practically uniform structure and composition throughout. The homogeneity, cleanness, and size of grain are dependent largely on the kind of deoxidizer used, and ferro carbon-titanium is considered one of the best for these grades of steel. By combining it with other deoxidizers, such as manganese, silicon, and aluminum, in correct proportions, the grain size can be controlled closely without impairing the cleanness and uniformity of the ingots.

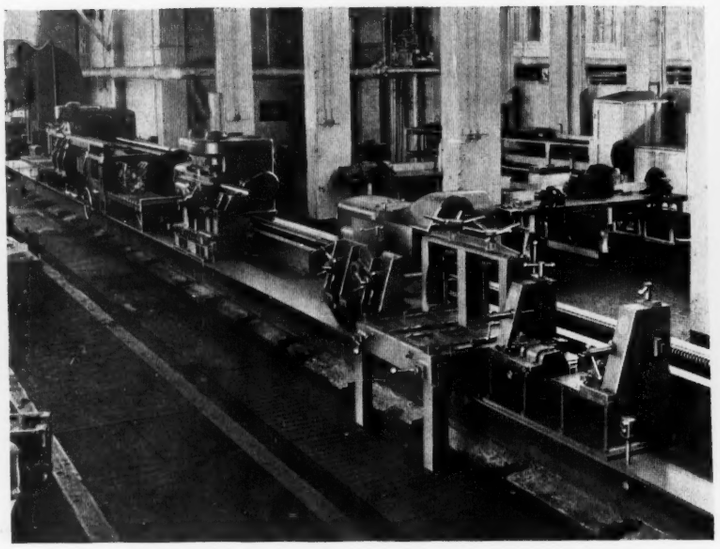
### *Castings Improved by Titanium Alloy*

Other automobile parts in which titanium has found a place are cast-iron cylinder blocks, aluminum pistons, and aluminum crankcases. Titanium is used in cast iron to make hard, strong alloy compositions more easily machineable and to close the grain or decrease the size of the graphite flakes. Its applications for both of these purposes are constantly increasing.

When the iron is melted in an electric furnace, titanium is cheaply and effectively added to the bath in the form of regular ferro carbon-titanium; but when ladle additions must be made, ferro carbon-titanium is not generally suitable, because it takes too long to dissolve in cast iron outside of a furnace. For ladle additions to cast iron, therefore, a low-carbon ferro-titanium should be used as a source of titanium, because it dissolves readily in the iron at ordinary foundry temperatures. This titanium alloy is often used in connection with chromium in alloy cast iron.

A titanium alloy known to the trade as "Webbite" has been developed recently for improving aluminum alloys, especially the well-known alloy containing 8 per cent copper. The addition of about 2 1/2 pounds of this alloy to 100 pounds of aluminum has a marked effect in reducing the grain size and improving the strength, soundness, and resistance to leakage of the castings. Considerable use has been made of this remarkable action of small amounts of titanium on aluminum alloys in progressive foundries, in spite of the short time that Webbite has been commercially available.

# Citroen Installs Latest Production Machinery



**Leading French Automobile Manufacturer Equips Cylinder Block and Head Lines with Power Pack Machines**

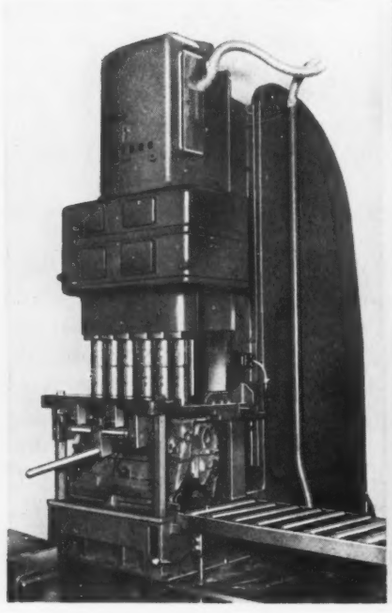
By GUNNARD R. OLSON
The Ingersoll Milling Machine Co.
Rockford, Ill.

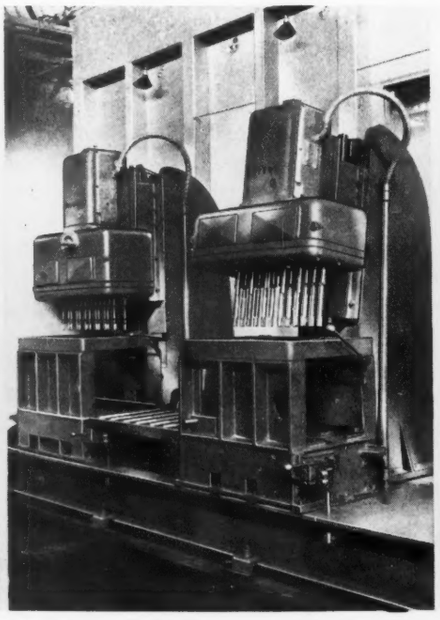
THE Citroen automobile plant in France ranks among the leading plants in that industry in Europe. It has always been known for its modern methods and up-to-date equipment, being equal in that respect to most American automobile plants. Recently, in accord with its policy of employing nothing but the latest high-production equipment, the company has installed a great number of the latest American production machines. Notable among the equipment purchased are entire cylinder block and cylinder head production lines, consisting of Power Pack equipment, built by the Ingersoll Milling Machine Co., Rockford, Ill. The general principle embodied in Power Pack equip-

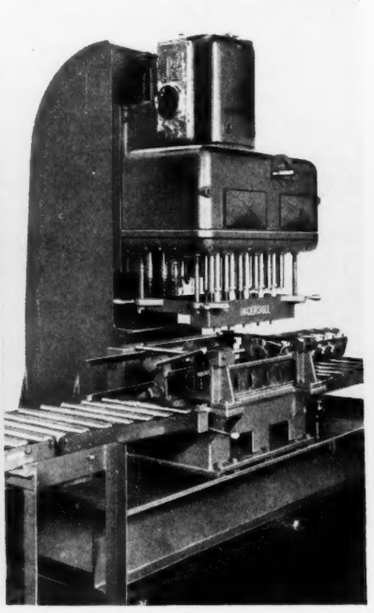
*Fig. 1. Six-spindle Vertical Boring Machine for Rough- and Finish-boring and Counterboring Sleeve Holes in Cylinder Blocks*

*Fig. 2. Boring and Reaming Valve Tappet Holes and Drilling and Tapping Stud Holes in Two Machines, Each Performing Two Operations*

*Fig. 3. Drilling and Tapping Top and Manifold Side of Cylinder Head, Drilling in the First Cycle and Tapping in the Second*







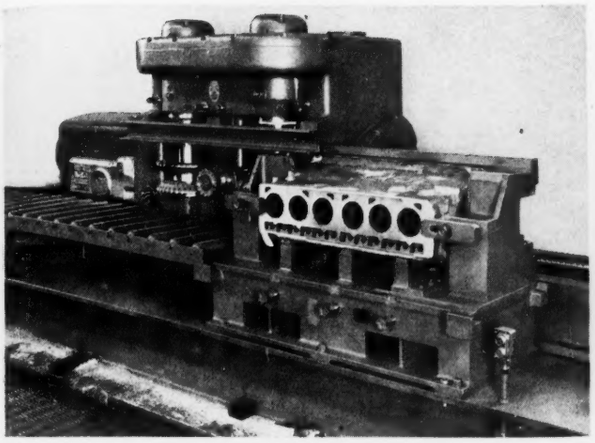


*Fig. 4. Four-spindle Milling Machine for Rough- and Finish-milling the Bearing Slots and Milling the Angular Oil-pump Pad on the Bottom Flange of the Four-cylinder and the Six-cylinder Castings*

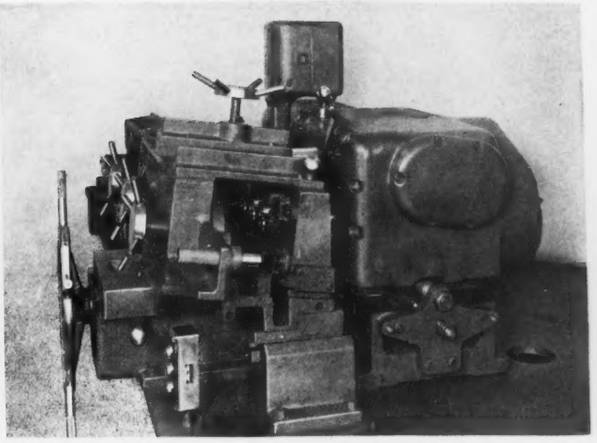


*Fig. 5. Three-spindle Milling Machine for the Cylinder Head Combustion Chambers. After Loading Casting and Feeding Fixture to Cutting Position, the Cutters Reciprocate to Form Combustion Chamber Contours*

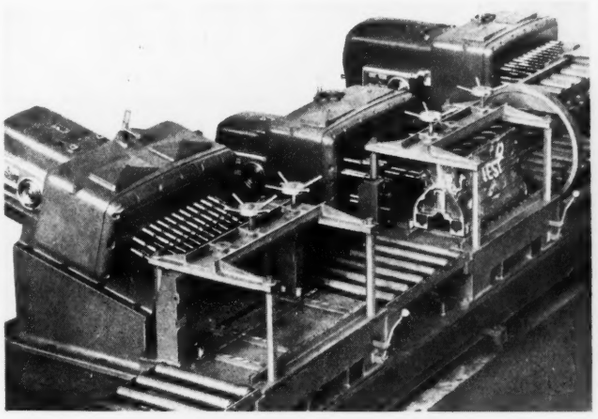


*Fig. 6. Three One-way Drilling and Tapping Machines for the Side Holes, Performing Drilling Operations in the First Cycle and Tapping in the Second*

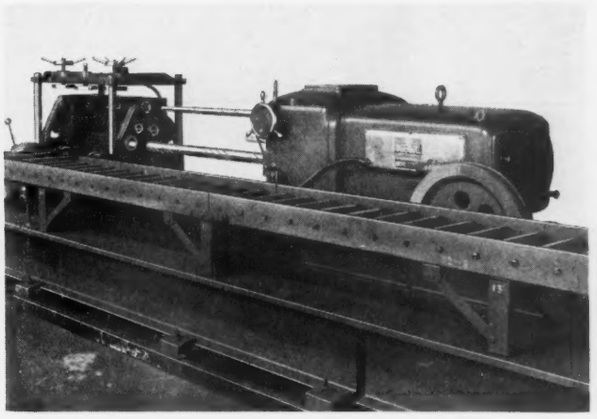


*Fig. 7. One of Two Four-spindle One-way Boring Machines Provided for Boring the Crank, Cam, Idler Stud, and Generator Holes in the Cylinder Block*

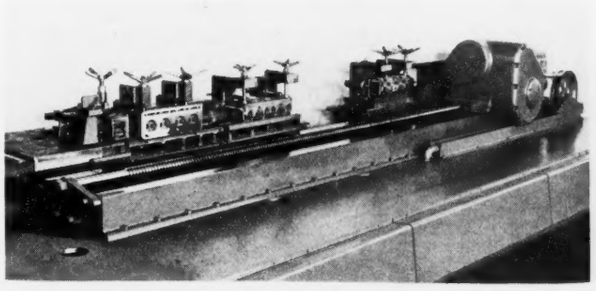


*Fig. 8. Horizontal-spindle Machine for Milling Bottom, Top, Side, and End Surfaces of Cylinder Head. Electrical Control Panels are Located beneath the Sheet-metal Covers in the Foreground*

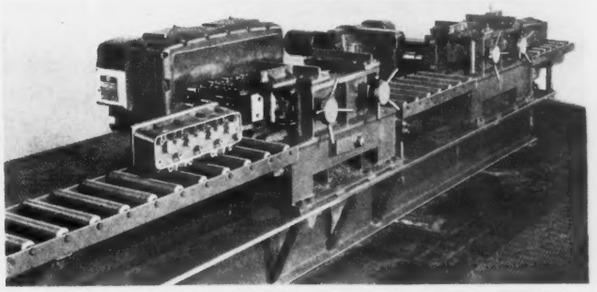


*Fig. 9. Section of the Cylinder Head Line, Showing, in the Foreground, a Horizontal One-way Drilling Machine for Drilling the Stud Holes in the Cylinder Heads for Bus and Truck Engines*

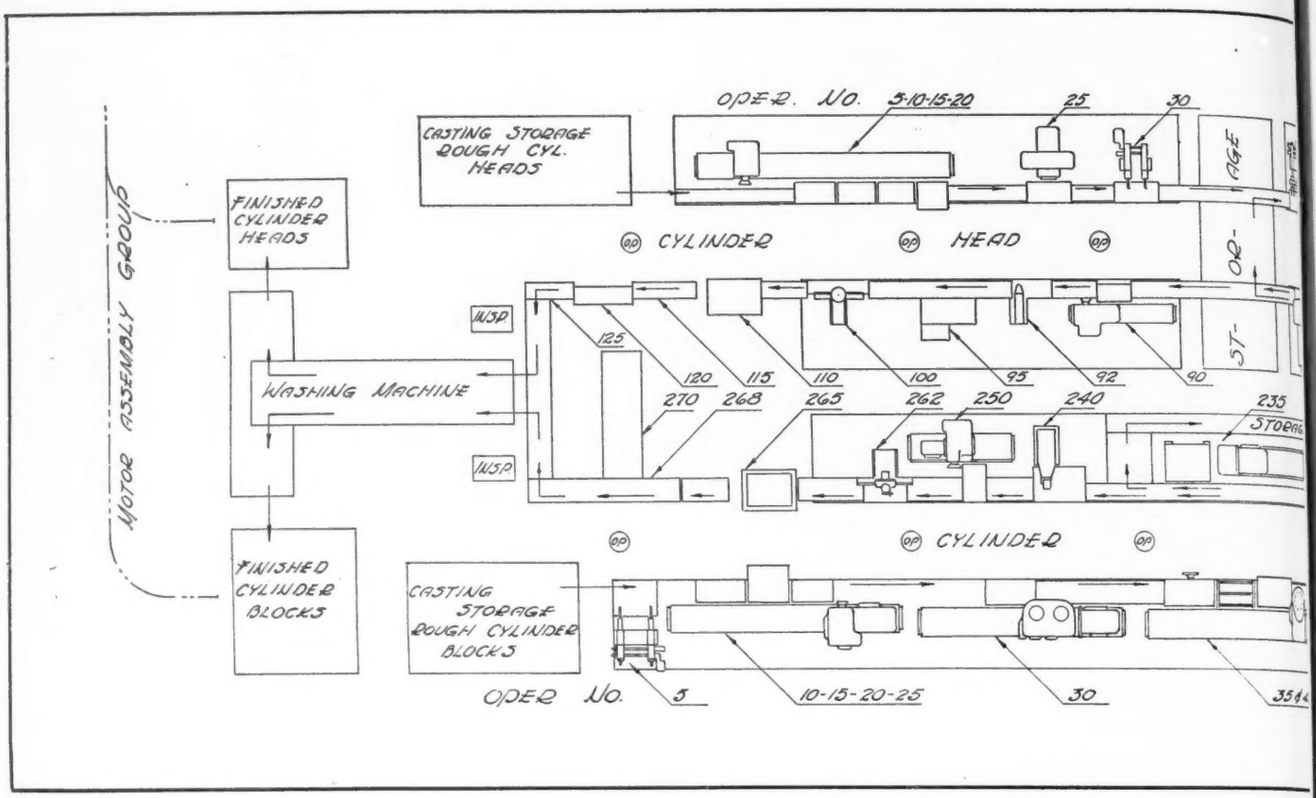



*Fig. 10. Floor Plan of Cylinder Block and Cylinder*

ment was described in an article in May MACHINERY, page 546. The present article will briefly describe the four lines of equipment just built for the Citroen company.

Two of these installations were furnished complete, including all machines, fixtures, tools, inspection gages, and handling equipment for producing completely machined cylinder block and cylinder head castings for a four- and six-cylinder bus and truck engine. The other two lines included all of the equipment for completely milling the cylinder block and head for a small four-cylinder passenger car.

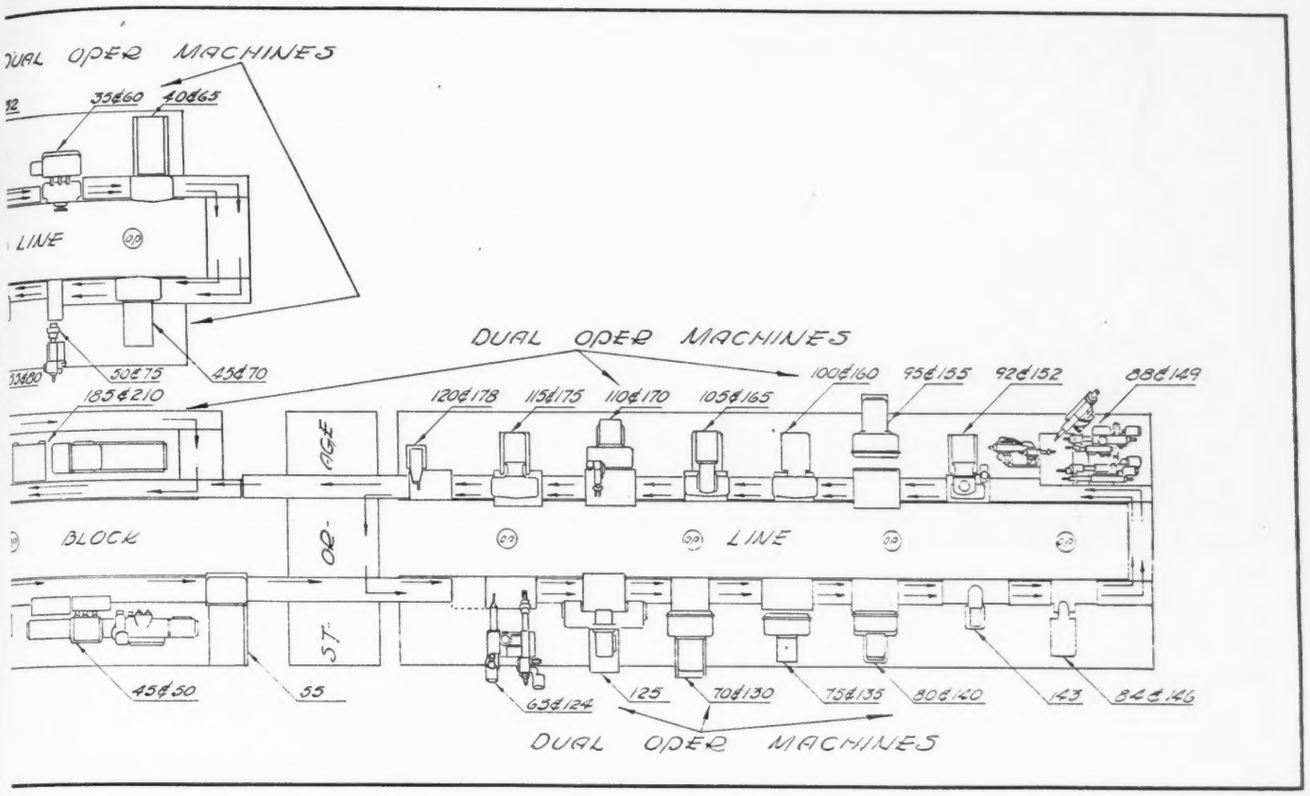
The Citroen equipment offers a striking example of the adaptability of Power Pack machinery to varied production requirements, whether comparatively small or large. It also serves as an excellent example of the application of this type of equipment to several kinds of machining operations.

In the installations for the bus and truck engines, a four- and six-cylinder block and cylinder head of similar dimensions are to be completely machined. A production of twenty castings in eight hours is required for the four-cylinder engine, and ten castings in eight hours on the six-cylinder type. This production may later be substantially increased. The problem, therefore, was to provide equipment for present production requirements without too great a capital expenditure. It is easily understood that when the total production is only thirty castings a day, the balance between first cost of equipment and direct labor cost is one difficult to achieve. A method of manufacturing to suit the requirements in the case was therefore worked out.

Because Power Pack machinery is adaptable to four major metal-removing processes—milling, drilling, tapping, and boring—it is possible to use a number of the machines for performing two operations without sacrificing the continuous flow of castings.

Fig. 10 shows a floor plan of the cylinder block and head departments. By following the arrows starting from the rough casting storage points, the paths of the castings can be traced. Briefly, the cylinder blocks pass through Operations 5 to 55, inclusive, in which locating dowel holes are drilled and reamed, the major milling operations are performed, and the sleeve holes bored. They are then transferred to the storage conveyor, where they are stored temporarily or else immediately transported to the dual-operation machines, depending on whether or not this group is set up for the first or second operation cycle.

In this group, the drilling, tapping, and reaming operations are performed. These machines, in most cases, perform a multiple-spindle drilling operation in the first cycle, after which they are adapted for tapping by changing from drills to taps, throwing a speed-change lever in the work unit, and resetting the Power Pack for a tapping cycle. During the




***Head Departments in the Citroen Plant in Paris***

change-over period, the castings are stored in the storage conveyor section, which also has sufficient capacity to take care of the castings coming from the first portion of the line.

After the dual operations have been performed, the bearing caps are assembled and the crank- and cam-shaft holes are rough-, semi-finish-, and finish-bored. One of the two crank and cam boring machines employed performs the roughing and semi-finishing operations, a storage conveyor that runs in back of the machines providing a casting bank to permit this. From this point, the block passes through several miscellaneous operations and through the washing machine. They are now ready for the engine assembly.

In the cylinder head line the same general method is employed. After the casting has passed through operations 5 to 30, inclusive, where the major milling operations are performed, the stud holes drilled, and two of them reamed for locating purposes, it is transferred to the storage section and passes through the dual-operation machines. Then the remaining operations, such as finish-milling the cylinder contact surface, assembling and reaming the valve guide bushings, etc., are performed, after which the casting is sent through the washing machine to the assembly line.

In all cases, the dual-operation machines have sufficient capacity to perform two operations and to provide a sufficient amount of spare time so that they can be reset from one operation to another while the remainder of the line is in production. Each machine and fixture has been designed to take care of the four- and six-cylinder castings without the necessity of removing the work units and fixtures, thus keeping the change-over time to a minimum.

It will be noted in the floor plan that the machines are set along both sides of a long aisle, the operators being located between the machines, where they can work across the aisle in a most efficient manner. Gates are provided in the conveyor sections so that all parts of the line are easily accessible.

The heading illustration and Figs. 1 to 9, inclusive, illustrate a number of representative machines. There are forty-four machines in all, performing a total of seventy-three operations. Notwithstanding the variety of operations represented, Power Pack equipment is adaptable to them all and is used in every case. As the operating mechanism for all machines is practically identical and the Packs are quickly and easily removable, the Citroen company was able, by the purchase of a few spare Power Packs, to insure uninterrupted production. Tests have shown that it takes approximately fifteen minutes to remove and attach a Power Pack. The replaced unit can be taken to the tool-room and repaired without loss of time in the production line.

The method of mounting this equipment is of un-

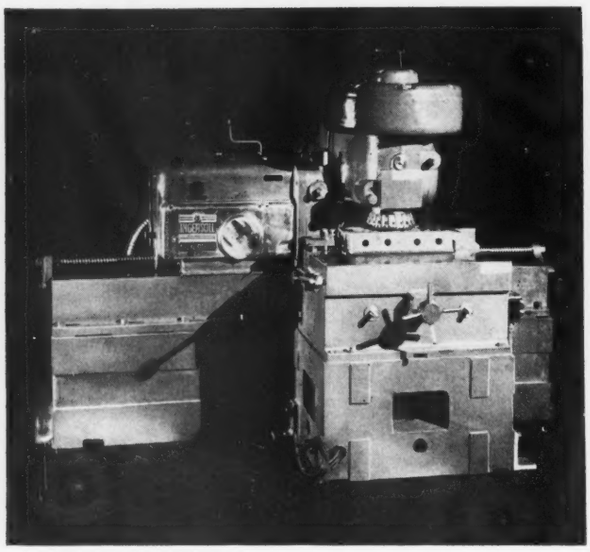


*Fig. 11. Two-spindle Milling Machine with Horizontal and Vertical Spindles for Rough-milling Top and Manifold Side of Head Casting*

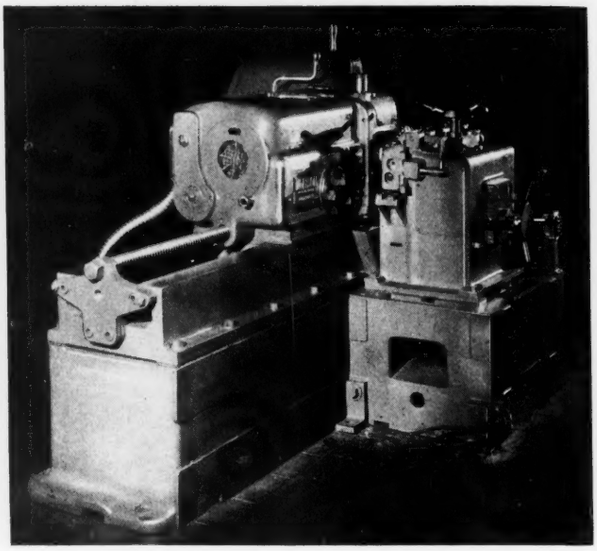


*Fig. 12. Single Horizontal-spindle Milling Machine Used for Rough-milling the Bottom Surface of the Cylinder Head for the Small Passenger Car*

usual interest. Instead of employing the usual individual fixture pedestals and bed ways, the machines and fixtures are set on 7-foot wide structural steel baseplates, of built-up welded construction, as clearly indicated in the heading illustration. The tops of these baseplates are milled and the machines and fixtures bolted in position, shims being used to line up the units with one another. This arrangement makes it possible to relocate the machines to allow room for additional units and operations or to rearrange them without the necessity of acquiring additional bases.

The electrically controlled panels for each operation are located on the back of the plates, each being

*Fig. 13. Three-spindle Milling Machine for Milling the Side Pads on the Small Four-cylinder Engine Casting*

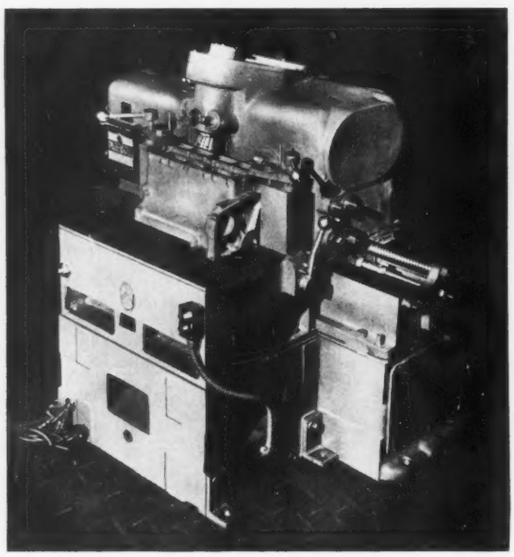
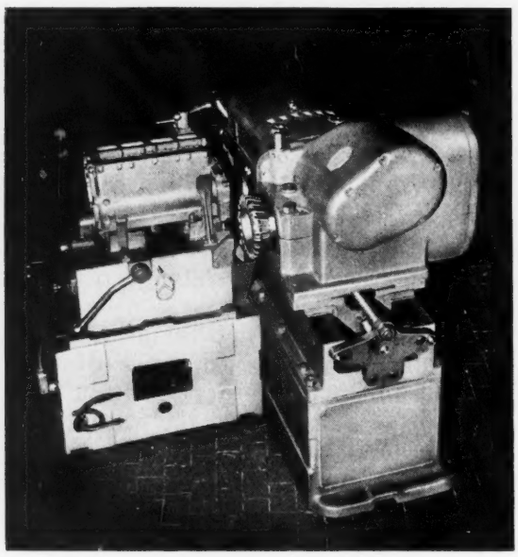


*Fig. 14. Single Horizontal-spindle Milling Machine for Finish-milling the Flanged End of the Small Cylinder Block*



enclosed by a sheet-metal cover made in sections, so that any section can be removed if required. Each control panel is connected to a bus bar running the entire length of the plate section. The baseplates are made in 20-foot lengths and are supported by I-beams running longitudinally and having flat steel sections running crosswise at the proper intervals. The conveyors are usually mounted on the front of the plate for efficient handling of the castings.

The Power Pack equipment for the small four-cylinder passenger car engine is of a somewhat different type. In this case, the Ingersoll Milling Machine Co. furnished the milling equipment only, and each machine was designed as a self-contained unit, including a fixed pedestal and bed wing, instead of being mounted on a baseplate, as is the case of the bus and truck engine equipment.

Twelve milling machines are used for the passenger car engine, the production rate being forty castings an hour. Each machine obtains its drive and feed from a Power Pack, and each is built up of the various functionalized units that constitute the principle of Power Pack machinery; yet each is designed for one specific operation and has a production capacity of forty castings an hour. Figs. 11 to 14 inclusive show close-up views of some of these machines. Again, a spare Power Pack for the twelve machines provides the necessary breakdown protection.

* * *

## Accurate Gear Lapping

In the article "How Nash Meets Quality Demands for Transmission Gears," published in May MACHINERY, page 534, a battery of five Fellows three-lap recess-type gear-lapping machines was referred to as being employed for finishing gears after heat-treatment. The action of these machines may be briefly described as follows: They employ three laps, which confine the work between them; and as these laps are made with different numbers of teeth, the points of contact on the gear cover a greater area, and hence provide more accurate control in the lapping operation.

The laps are made to the same helix angle as the gear; and if the gear has been slightly distorted in lead in hardening, the laps will restore the gear to its original lead. The rigid construction of the machine makes this control of lead possible. There are no adjustments of the lap spindles, except a slight angular adjustment, which can be employed when the machine is used for salvage purposes, but which is not intended for use in regular production work.

Lapping is not accomplished by "crowding" the gear against the laps; hence there is little danger of spoiling the lap contour by excessive pressure. Instead, the laps and work are held at a fixed center distance and are run together with sufficient backlash to prevent crowding. The lapping pressure is obtained by means of independent adjustable friction brakes on all three lap spindles.

The last sentence in the same article stated that after the gears are assembled into the transmissions, they are given a final inspection on gear measuring machines. All checking of gear-tooth shapes is, of course, completed before such assembly.

* * *

## Precision Helical Springs Produced After Extensive Research

Helical springs used for accurate weighing scales in the past have had to be corrected with temperature compensation devices and mechanical means in order to offset four errors which have been considered inherent and inescapable. These errors have been due to the effect of temperature changes on the springs, to fundamental errors in formulas based on the Hooke Law, to creep of the spring material, and to hysteresis and its inter-related back error, which makes the contraction in unloading a spring differ in amount from the elongation obtained when the spring was loaded.

Five years ago John Chatillon & Sons, New York City, instituted a research, with the aim of developing a spring that would stretch in accurate proportion to the load. Extensive mathematical investigations were made by Professor Mortimer Sayre of Union College to obtain a formula that would take care of deviations in helical springs designed according to the Hooke Law. Metallurgical research work, undertaken to secure a spring material that would be unaffected by temperature changes and would possess the necessary elasticity, was conducted by Dr. A. V. de Forest. These research activities were directed by Robert B. Wasson.

Two important results of this research were the development of a chromium-nickel alloy for precision spring manufacture, to which the trade name of "Iso-Elastic Metal" has been given, and the development of a spring design formula that gives extremely accurate results.

When springs are made of this new material, the creep error under stresses of 60,000 pounds per square inch in torsion is less than one part in 5000, as compared with twenty-five parts in 5000 for ordinary spring steel. The hysteresis error is less than one-third the error obtained with good spring steel.

Wire of rectangular cross-section has been adopted for making precision springs, and these springs are now made in two sections, one being coiled right hand and the other left hand. The manufacturer states that these "Iso-Elastic" springs are suitable for many applications besides spring scales. One concern has adopted them for use in force measuring and indicating apparatus.

* * *

Mere change does not necessarily indicate progress.

# The Capital Goods Industries and The Fear of Overproduction

***In an Address Before the United States Chamber of Commerce, Abstracted Below, Ralph E. Flanders, President of the Jones & Lamson Machine Co., Stressed the Fact that Our Real Trouble is Not Overproduction but Underconsumption***

THE problem of boom, depression, and recovery centers about the corresponding stimulation, collapse, and revival of the capital goods industries and the banking operations by which they are financed. Several economists have come to the conclusion that practically the entire drop in business and unemployment can be accounted for by the drop in the capital goods industries and the decrease in consumer goods industries caused by it. It seems reasonably certain that the monetary problem and the capital goods problem are closely tied together.

Both governmental and private policies affect the demand for capital goods in general and for machinery and equipment in particular. Until recently the governmental factor has been the controlling one. Certain changes in policy and proposed modifications in legislation in the last few weeks indicate that the bars to recovery in this direction are being raised. If so, private business and finance will have the major responsibility placed in their hands. The question is, will private enterprise rise to the challenge?

### *What Prevents the Purchase of Improved Equipment?*

To visualize the problem, let us examine the experience of a capable salesman of machinery, working for a progressive firm that has had the resources and courage to improve its product during the depression. Its 1934 line of machinery is more productive per dollar of first cost and per dollar of labor cost, is more economical in power consumption, turns out a better and more accurate product, and is less subject to wear and breakdowns than the 1929 model. Full of confidence in his product, the salesman sets out to convince a customer and close an order. His main reliance is on a cool, honest engineering analysis of the work the customer has to do, and of the efficiency of his machine in doing it. He convinces the mechanical executive responsible and would get his order if this were the final step.

But it is only the first step, and today, all too often, a step that leads nowhere. The requisition from the mechanical executive is met higher up with the announcement of the fixed policy "no capital expenditures." It matters not that business on the whole is improving; it matters not that the purchase is justified on the present scale of operations; it matters not that the new equipment will pay for itself in five years, in one year, or (as sometimes happens) even in six months; it matters not that the customer has available resources and credit. In thousands of cases in the last few months, every element has been favorable to increased business in the capital goods industries until somewhere along the line—in the board of directors or in the controlling forces of the customer's banking connections—there has been a cold hand closed around the throat of what was a healthy business prospect.

Admittedly, the situation described has been slowly changing, and for the better. Let credit be given to the changed governmental attitude as the principal single cause of that improvement. Yet the tendency is still so marked as to be a serious brake on the progress of recovery. Is it an expression of proper caution, or is it a senseless, subconscious fear and hangover from the depths of the depression?

### *Are We Overequipped and Have We Overproduced?*

It seems that there is such a sub-conscious fear and that this very complex is due to the irrational conviction that we were overequipped and that we overproduced in 1929. Such beliefs are buttressed by a formidable collection of facts. We have all the railroads we need; there are too many coal mines; wheat and cotton have smothered their markets; we have no longer a frontier calling for expansion and development; immigration has ceased; and the population curve is beginning to find its level. Even in 1929, all our industrial capacity was not fully taxed, nor were all those able to work employed.

This and much more is all true. In part, it is a statement of unfinished large-scale adjustments as between agriculture and industry, as between different branches of industry, and as between industry improving in efficiency and the growing service occupations. These needed adjustments constitute a serious problem.

The seriousness of this problem disappears, however, in the light of the constructive possibilities that open before us, for we did not overproduce goods and services as a whole in 1929; nor have we ever done so at any other time. No nation with natural resources, character of population, and inventive and organizing genius comparable to ours, in which a large part of the population that is able and willing to work has no better food, clothing, shelter, and cultural satisfaction than that enjoyed by millions even in the boom of 1929, can be said by any stretch of the imagination to have overproduced. We were at that moment, and before and since, suffering from underproduction and underconsumption.

### *The Right Course Ahead*

We have two things to do—rid ourselves of fear and rid ourselves of folly. Something has been said about the fear; now let us add a word or two about the folly.

We must learn to be content with business profits, the rewards that come from the exercise of wealth-producing — not wealth-appropriating — activities. It will always prove fatal if we make our principal interest the search for speculative gains.

Business must not seek to protect itself unduly, but must be willing to face the dangers of such a degree of competitive freedom as will insure the continued success of efficient management, and encourage the passing on of the fruits of efficiency to the consumer in the form of lower prices.

Financial interests must refrain from building up top-heavy credit and speculative structures and must be willing to look to true business services for their profit.

If we avoid these follies, we need not fear, for we still have frontiers ahead of us. They are no longer geographical ones; they are social frontiers. One of these social frontiers is the forty-hour week—a new departure in the balancing of human values between labor and leisure—a dividend due to our improved machinery and management, partly earned by past performance, partly based on the faith in future efficiency not yet attained. This frontier has only been rudely mapped. It has not been occupied and settled. It is going to take better machinery, better methods, better organization than we have ever had to maintain that frontier position and at the same time make that advance in the general standard of living to which our workers are entitled by reason of our engineering advance.

These hopeful prospects, these justifiable ambitions, should become the guiding stars of business, of finance, and of government.

Critical judgment and *caution* are the qualities demanded in the flood tide of prosperity, but the need of the present is for critical judgment and *courage*.

# Responsibility of Employer and Employe Under the NRA

***A Statement Made a Year Ago— June 6, 1933 — by a Prominent Trade Association Executive, that Assumes Especial Significance in the Light of Later Events***

THE great gap between employer and employe that existed for decades has been narrowing so rapidly during the last four years that the understanding that each has shown of the troubles of the other is a remarkable feature of the depression. It is not rare to hear workers express concern for their employer's business, nor for the employer to do everything possible to stand by his employes in these difficult times. In the effort to hold in check the cutthroat business competitor and the wage cutter, it seems essential that the relations between the fair employer and his employes should not be thrown out of balance, but should be surrounded by conditions that will permit this mutual understanding and respect to further grow and develop.

The labor provisions in the National Industrial Recovery Act appear to endanger normal progress along this line. Neither employer nor employe object to the establishment of minimum wages and maximum hours, nor is the employer generally averse to the principle of collective bargaining; but both the employer and the intelligent employe fear that the provisions of Section 7 of the bill will create a favorable field for racketeering, because, while coercion, restraint, and interference cannot be used by the employer to keep employes from joining a labor organization, any amount of pressure may be brought to bear upon the employe to force him into a labor organization, even though the conditions in his plant may be entirely satisfactory to him.

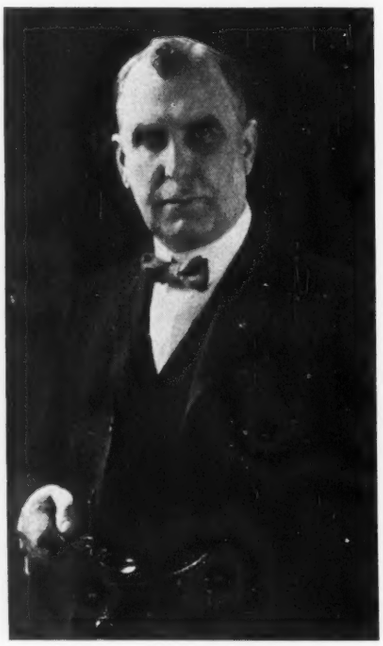
Would it not be fair to both parties, and to all others interested, if exactly the same conditions were imposed on both sides? Whatever prohibition is placed against the employer as regards interference, coercion, or restraint, should be applied equally against the labor organization. Racketeering, unfair regulations, and duress on the part of unions should be guarded against by the same procedure as is provided for industry.

Obviously, it is only by keeping the relations between employer and employe in a balance fair to both that the object of the legislation—to create a condition of fair wages, fair hours, and steady earning power—can be accomplished and continued.

# Gear Manufacturers Discuss Standards and Codes

AT the eighteenth annual meeting of the American Gear Manufacturers' Association, held at the Penn-Lincoln Hotel, Wilkinsburg, Pa., May 3 to 5, the keynote of the convention was the standardization program. Reports were presented by a large number of the standardization committees, and the report on Computing the Load-carrying Ability of Metal Spur Gears, submitted by Professor Earle Buckingham of the Massachusetts Institute of Technology, was accepted by the Association as recommended practice.

In addition, a number of papers containing definite technical information were read. One of the most outstanding of these was entitled "Helical and Herringbone Speed-reducer Ratings," presented by W. P. Schmitter of the Falk Corporation, Milwaukee, Wis. In this paper, the author covered the different considerations that must be taken into account in designing speed reducers with gears, bearings, and shafts having the required properties. He demonstrated the development of formulas for the calculation of all important factors and dimensions, supported by a mass of experimental data, charts, and tabular information.



John Christensen, Newly Elected President of the American Gear Manufacturers' Association

Other papers were presented as follows: "Controlling Costs and Employe Compensation," by W. A. Barr, manager of manufacturing, Foote Bros. Gear & Machine Co., Chicago, Ill.; "Selling Gears to Special Fields," by L. A. Graham, sales manager, Falk Corporation, Milwaukee, Wis.; "Economical Advantages of Single-helical Gears," by Richard S. Marthens, Westinghouse Electric & Mfg. Co., Nuttall Works, Pittsburgh, Pa.; "Steps Toward a More Uniform Price Structure," by E. S. Sawtelle, vice-president and general manager, Tool Steel Gear & Pinion Co., Cincinnati, Ohio; "Steels for Heat-treated Gearing," by T. R. Rideout, Westinghouse Electric & Mfg. Co., Nuttall Works, Pittsburgh, Pa.; "The Machine-hour Rate, Its Importance and Computation," by Professor C. L. Van Sickle, University of Pittsburgh; and "Noise Measurement of Gears," by Professor F. A. Firestone, University of Michigan. The points brought out in Professor Firestone's paper were demonstrated by noise-measuring apparatus. One interesting point to which attention was called was that the energy required to produce noise is very small, so that noise, by itself, is not necessarily an indication of low power-transmitting efficiency.

At the annual dinner, Ralph E. Flanders, president of the Jones & Lamson Machine Co., Springfield, Vt., spoke on the economic prospects and the future possibilities in industry, covering the subject in his usual clear-cut, logical manner and bringing out many of the points that he also emphasized in his recent address before the United States Chamber of Commerce (see page 616 of this number of MACHINERY).

On the day following the conclusion of the annual meeting of the American Gear Manufacturers' Association, the gear-manufacturing industry held its annual code meeting. H. H. Kerr of the Boston Gear Works, Inc., chairman of the code authority for the gear industry, reported to the manufacturers, and Howard Dingle of the Cleveland Worm & Gear Co., Cleveland, Ohio, spoke on "NRA Today and Tomorrow." Reports were presented by the chairmen of the code authorities in the different administrative areas.

The following new directors of the American Gear Manufacturers' Association were elected: Howard Dingle, Cleveland Worm & Gear Co., Cleveland, Ohio; E. W. Miller, Fellows Gear Shaper Co., Springfield, Vt.; E. S. Sawtelle, Tool Steel Gear & Pinion Co., Cincinnati, Ohio; and E. P. Connell, Falk Corporation, Milwaukee, Wis. Officers for the coming year were elected as follows: John Christensen, Cincinnati Gear Co., Cincinnati, president; A. A. Ross, General Electric Co., West Lynn, Mass., vice-president; J. H. Jackson, Pittsburgh Gear & Machine Co., Pittsburgh, treasurer; J. C. McQuiston, Wilkinsburg, Pa., manager-secretary.

# Machine Tool Builders Meet in Chicago

The thirty-second spring convention of the National Machine Tool Builders' Association was held May 23 to 25 at the Edgewater Beach Hotel, Chicago, Ill. In conjunction with the convention, a meeting was held by the machine tool industry as a unit under the NRA code provisions. At this meeting, the chairman of the Supervisory Agency of the machine tool industry, Henry Buker, vice-president of the Brown & Sharpe Mfg. Co., presented a report. This was followed by a discussion of the various code provisions, including registration of prices, industry statistics, fair trade practices, and a report of the Committee on Costs. The activities of the Durable Goods Committee were also reported upon.

At the regular convention of the National Machine Tool Builders' Association, which followed the industry meeting, many subjects of special interest to the industry were dealt with. Herman H. Lind, general manager of the Association, spoke on "Industry Selling," while Frederick B. Heitkamp, sales manager of the Cincinnati Milling Machine Co., presented a paper on "Selling Technique." Harry Tipper, executive vice-president of the American Manufacturers' Export Association, spoke on "The Future of Machine Tool Exports."

An address entitled "The Question of Company Unions" was presented by C. H. Ching, director of industrial and public relations of the U. S. Rubber Co. A report on the activities of the Machinery and Allied Products Institute and its relation to the National Machine Tool Builders' Association was presented by Robert M. Gaylord, president of the Ingersoll Milling Machine Co.

# Buying Machine Tools Table d'Hote or a la Carte

I read the article on the buying of machine tools on page 538, May MACHINERY, with a great deal of interest. Our firm has always taken the point of view that "*service* is something rendered to the incompetent at the expense of the competent," and we have charged for such service a nominal price of $15 for an eight-hour day, plus transportation and living expenses.

In connection with our proposals, we send a printed statement of the conditions under which the machinery is sold. Some of the clauses read as follows: "All orders are accepted subject to a thorough and satisfactory demonstration and tryout of the machinery at our works in Worcester, Mass., in the presence of the customer's representative, before acceptance and shipment.

"We guarantee material and workmanship as against any defects for a period of six months from delivery, when given normal and proper usage, and when owned by the original purchaser.

"Where production figures are given, it should be clearly understood that they are estimates only, based on our experience, and our understanding of the limits of accuracy required, the quality of the material, handling facilities provided, and any other points stated in each individual item of this proposal.

"Should service in the teaching of operators, or in the erection, demonstration, or repairing of any machines offered in this proposal be requested, such service will be rendered at a charge of $15 per day for each service man, plus transportation and living expenses, unless such service is specifically mentioned as included in the quoted price."

I think it would be of considerable value to the machinery industry to have this subject thoroughly discussed in the columns of MACHINERY.

G. D. HARTLEY, General Manager
Sleeper & Hartley, Inc., Worcester, Mass.

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Everyone tells me that the ideas recorded in the article on buying machine tools published in May MACHINERY are in the right direction. I have objected to indiscriminate free service, free demonstration, and production guarantees for many years, and lately took up this question with the National Machine Tool Builders' Association, trying to induce the Association to write into the Machine Tool Code that machine tools requiring demonstration in the customer's shop should first be accepted by the buyer in the builder's shop. Then if the machine requires demonstration in the buyer's shop, the builder should receive payment for the demonstrator's time and all expenses. If the purchaser has to pay for the demonstration, there will be much less demonstration required.

Instead of having machines demonstrated in the customer's plant, it would be far better if the customer would send a couple of intelligent men to the machine tool builder's plant to see the machine assembled and to watch the builder's mechanics operate the machine and test it out on the customer's work. Then when the machine arrives in the customer's plant, he would have experts in his own employ who would fully understand the operation and adjustment of the machine.

P. HALL, President
Hall Planetary Co., Philadelphia, Pa.

# New Machine for Checking Involute Profile of Gear Teeth

WITH a view to determining accurately the nature and amount of error in the involute curve of gear teeth, so that proper corrections can be made, the Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill., has placed on the market an involute profile measuring machine that will check an involute curve to 0.0001 inch. This instrument, as shown in Fig. 1, has been designed especially to provide for rapid set-up and quick readings for the general run of automobile, truck, and tractor gears, although, obviously, the machine can be applied to gears for any purpose within its capacity. Gears up to 10 inches in diameter and with shafts up to 13 inches between centers can be measured in the machine.

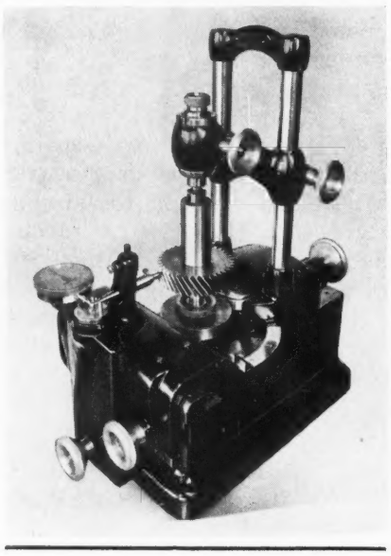


Fig. 1. Illinois Tool Works Involute Profile Measuring Machine

Cluster gears and gears integral on the shaft can also be checked, as they are readily reached by moving the indicator slide of the machine to the desired position. Gear-shaper cutters can be held on shoulder-arbors and readily checked on either side of the tooth by merely swinging the dial indicator from the right to the left position. Spiral gears can also be readily checked. All that is necessary is to turn the contact finger to the approximate slant of the spiral in the gear. The machine permits of the involute curve being checked in increments which may be plotted into a graph for recording purposes.

In checking involute curves with this machine, the only auxiliary equipment required are disks or base circles, which must be made for each different gear to be checked. These base circles are ground on the outside diameter to limits of plus or minus 0.0005 inch. The outside cylindrical surface must be true and parallel with the axis. The base circles may be made from cast iron, but steel is preferred, although there is no need of hardening them.

On spiral gears or gears with shallow tooth form, the base circle occasionally is smaller than the root diameter of the gear. In that event, care must be taken, in using the instrument, to avoid bumping the contact finger against the root surfaces of the gear. Inasmuch as the contact finger must be exactly even with the straightedge of the instrument, and as the straightedge rolls on the base circle, it is evident that if the root diameter is larger, there will be interference with the contact finger, as indicated in Fig. 2; yet the involute curve can be checked from the bottom fillet to the top of the tooth without interference.

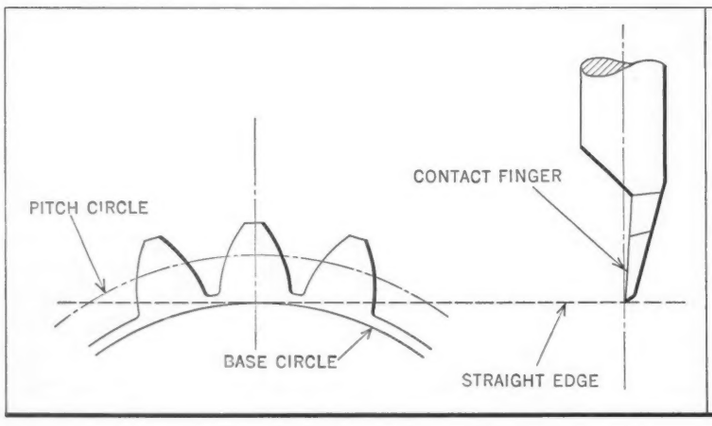



Fig. 2. Diagram Illustrating Condition when the Base Circle of a Gear is Smaller than the Root Diameter

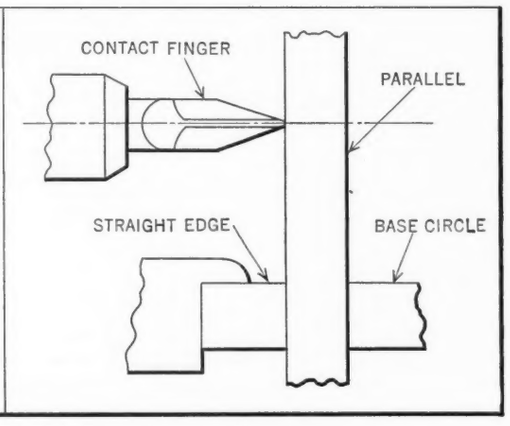



Fig. 3. Method of Resetting Contact Finger after it has been Ground

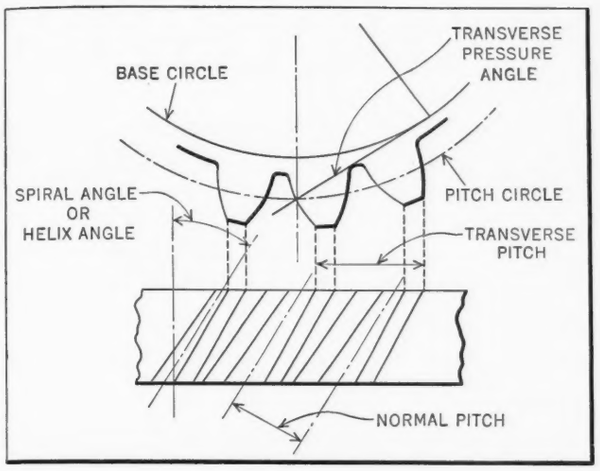



Fig. 4. Diagram Defining Transverse and Normal Pitch in Helical Gears

Whenever the contact finger needs to be ground to present an unworn surface, the grinding should be done on the end of the finger. The finger is so shaped that it will present the same kind of contact to the gear tooth at all times. To reset the finger even with the straightedge, place a parallel on the straightedge, as shown in Fig. 3, and swing slowly by the contact finger until the end of the finger just touches the parallel. The finger has an adjustment screw at the back to facilitate its adjustment.

In checking helical gears, it is necessary to find the transverse (plane of rotation) pressure angle of the gear to obtain the correct base circle. All involutes are checked in this transverse plane.

The method of finding the base circle and transverse pitch of helical gears is indicated in Fig. 4 and may be expressed by the following rules:

The tangent of the normal pressure angle multiplied by the secant of the helix angle equals the tangent of the transverse pressure angle.

The cosine of the transverse pressure angle multiplied by the pitch diameter equals the base circle diameter.

The normal circular pitch multiplied by the secant of the helix angle equals the transverse circular pitch.

The number of teeth multiplied by the transverse pitch equals the pitch circumference.

Usually information pertaining to helical gears is given in the normal plane. The simple rules given will permit transposition of the normal dimensions to transverse dimensions (that is, to dimensions in the plane in which all the involute curves unwind).

Errors in machining and heat-treatment distortions in gear teeth can readily be discerned with this device for checking the involute profile, and steps taken to correct the errors. If for any reason the instrument needs adjustment, it is so designed that each functional unit can be easily removed without interfering with the other units. The height of the machine is 30 inches; length, 27 inches; and width 12 inches. It weighs 276 pounds.

* * *

## An Electric Furnace that Reduces Malleableizing Time

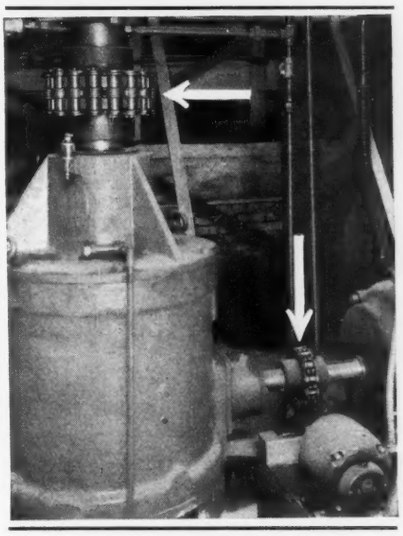
The time required for malleableizing castings has been reduced from six-, eight- or ten-day periods to seventy-two hours or less by an electric furnace recently brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Twenty-six hour cycles have proved satisfactory for castings 1/2 inch thick, when their analysis has been carefully controlled.

Another advantage claimed for this furnace is the elimination of decarburized surfaces, hard skin or hard spots on the surface, picture-frame structures, and burned or scaled castings. In this furnace, the atmosphere is automatically controlled. A definite time-temperature cycle is laid out for the castings handled. Furnaces ranging in size from 1/2 ton to 25 tons are built.

* * *

## Two Roller-Chain Couplings Make a Compact Drive

A roller-chain flexible coupling on a horizontal shaft, transmits the power of a 30-horsepower motor, as shown in the accompanying illustration, to a speed reducer. From this speed reducer, the drive is transmitted through a second roller-chain coupling on a vertical shaft. This shaft runs at 12 revolutions per minute and drives a brewery mash tub on the floor above. The second flexible coupling embodies a double roller chain of 2-inch pitch, whereas a single roller chain is used on the motor coupling.



Two Diamond Roller-chain Couplings that Provide a Compact, Accessible Drive

Both couplings were made by the Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind. They provide a quiet, positive drive, take up little room on the shafts, were easily installed, and could be readily disconnected in case repairs to the equipment should become necessary.

# MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

## Galvannealed Sheets Resist Chipping, Peeling or Flaking

Zinc-coated sheets on which the coating adheres so tightly to the base metal that even severe forming operations fail to make it peel are now being produced by a patented "Galvannealed" process. According to information supplied by the Republic Steel Corporation, Youngstown, Ohio, the process consists of pickling and hot-dipping black sheets in zinc in the same way as in galvanizing. However, instead of permitting the sheets to cool off after their removal from the galvanizing tank and thereby allowing the zinc to crystallize into the familiar galvanized spangle, they are passed through a high-temperature heat-treating furnace.

The contact of the zinc with the iron or steel base at the high temperature results in the formation of a series of iron-zinc alloys between the pure zinc on the outside and the base metal. The zinc content of these alloys decreases so gradually from the surface to the base metal that there is no sharp line of demarcation between the coating and the sheet, the coating becoming an integral part of the sheet.

Galvannealed sheets can be painted, lacquered, or enamelled without preliminary priming or weathering. They are used extensively for outdoor display signs, highway markers and signs, refrigerators, washing machine parts, outdoor metal furniture, metal doors, street cars, buses, furnaces, and many other products subjected to moisture or heat.

Galvannealed sheets can be readily spot-welded and soldered. Under service conditions they have resisted flaking at temperatures up to 700 degrees F.

## The Workability of Olympic Bronze—A Copper-Silicon-Zinc Alloy

Olympic bronze is the name of a high-strength copper alloy containing silicon and zinc, which is sold by the Chase Brass & Copper Co., Inc., Waterbury, Conn. This alloy is made in three types: Type A is available in cold- and hot-rolled plates and sheets; strip, rod, wire and tube stock; forgings; and welding rod. Type B can be supplied in the form of free-turning wire and rod. Type C is available in ingots for casting purposes and in sand castings. The tensile strength of Olympic bronze ranges from 40,000 to 150,000 pounds per square inch, Type C castings having a strength of from 40,000 to 45,000 pounds per square inch, and the very hard drawn Type A wire having a strength of 150,000 pounds per square inch.

All types of Olympic bronze can be welded or brazed, carbon arc welding being recommended for sheets up to 3/16 inch thick, and oxy-acetylene welding for heavier sheets. Metallic arc welding can also be employed for all gages, but it is said to be more difficult than the other processes. The machineability of Type A Olympic bronze is only slightly better than that of hard copper or hard non-leaded commercial bronze, but Type B is designed especially to combine good machining properties with other desirable characteristics. The improved machineability of this type is obtained at a sacrifice of the hot-working properties, although other physical properties are only slightly affected. Type B can be machined in automatics at about two-thirds the speed of free-turning brass rod.

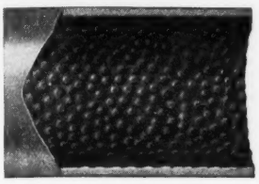
Types A and B can be readily cold-worked by all common methods. Type A can also be hot-worked easily, and is therefore particularly recommended for manufacturing high-strength corrosion-resistant forgings. The preferable temperature for general forging is between 1600 and 1650 degrees F. This alloy is malleable over a much wider temperature range than ordinary forging brass. However, it requires a higher forging temperature and greater force to effect a given metal displacement.

## The Modern Izaak Walton Uses Hooks of Stainless Steel

Rusty fishhooks are a source of annoyance to the fisherman who takes pride in his piscatorial equipment. The rusting of hooks is especially frequent in sea fishing or when salt-pork rind is being used to tempt the wily denizens of fresh-water streams. According to the *Enduro Era*, published by the Republic Steel Corporation, Central Alloy Division, Massillon, Ohio, fishhooks made from stainless steel are being used successfully to resist corrosive action.

## Steel Conduit with Raised Knobs on Inside Surface

Metallic tubing intended for use as conduit in the electrical field is being manufactured by Steels & Tubes, Inc., Cleveland. Ohio, with small round knobs covering the inside surface. These knobs provide a multiplicity of contact surfaces when an electrical cable is pulled through the tubing. It is claimed that the friction in pulling cable through this conduit is 30 per cent less than with conduit of the conventional design, which has a continuous smooth internal surface. The new conduit is known as "Electrunite Steeltubes."



Electrical Conduit with Small Raised Knobs that Reduce the Contact Area in Pulling Cables through the Tubing

## Chromium-Bonded Sheets for Brilliant Displays

Striking effects in exposition or window displays can be obtained through the use of Chromflex—a thin sheet material that is chromium-plated on one side. This sheet metal is available in crimped, fluted, and striped designs, as well as flat. Chromflex sheets are made by the Apollo Metal Works, La-Salle, Ill., with either a high polish or a satin finish. They come in thicknesses of from 0.010 to 0.032 inch and in width and length dimensions of 36 and 84 inches, respectively.

Plywood with Chromflex sheets on one side has been used to decorate the interior of the Ford Building that is a feature of the Century of Progress Exposition this year. Chromflex can also be mounted on wood molding.

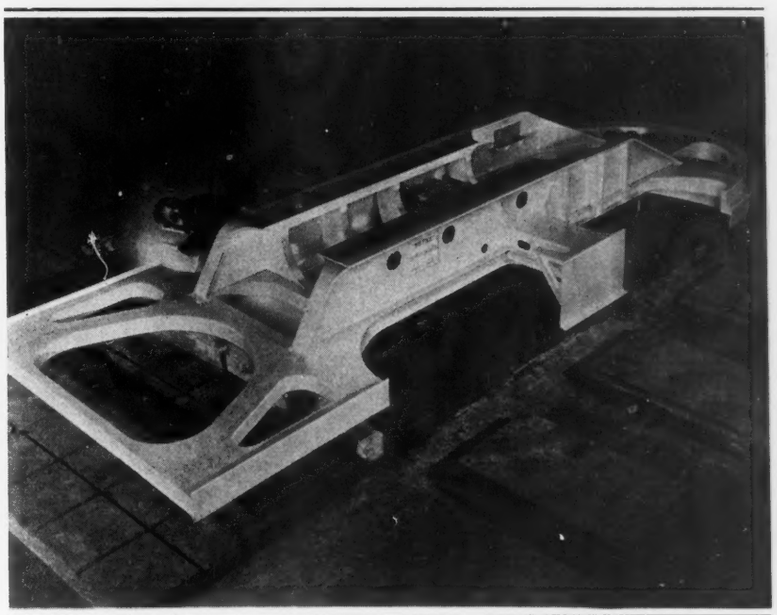
Chromium-bonded sheets in a fluted design are also manufactured by the American Nickeloid Co., Peru, Ill., for merchandise display purposes. These sheets are regularly produced in 30- by 84-inch and 36- by 84-inch sizes as well as in multiples of these sizes.

## Today's Automobiles Owe Much to Improved Materials

In the early days of the automobile, according to C. N. Dawe in the *Automotive Daily News*, bushel baskets filled with gears and bearings broken in service were common sights in automobile plants. Frequently broken axle shafts were seen piled room high.

Men who have since risen to high places in the industry laughed at the idea of "looking at steel through a glass" and photomicrographs of grain structures were derisively called "pictures of cookies." One automobile executive who decided to try out a set of heat-treated steering knuckles and arms in his car suggested the same experiment to a fellow executive and met with the response "Nothing doing! I don't want any tempered steel in my car; I've seen enough tempered tools bust."

Today, cars run from 50,000 to 100,000 miles under trying conditions of speed and rough handling without the failure of a part. This performance is due largely to the tremendous advances in materials and heat-treating methods that have been accomplished through the efforts of metallurgists. Only two different types of alloy steel were used in the early automobiles—today there are more than forty.



The Electric Arc and Cromansil High-strength Alloy Steel Produce the Bed for a High-speed Streamline Passenger Train. This Bed Weighs Three Tons and Supports Thirty. It was Fabricated by Lukenweld, Inc., Division of the Lukens Steel Co., Coatesville, Pa. Two Hundred and Four Plates were Cut Out by the Oxy-acetylene Torch for This Structure and Shaped in Heavy Presses Ready for Welding.

# NEW TRADE LITERATURE

## Power Transmission and Material-Handling Equipment

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill. General catalogue 600, containing 1024 pages covering the Link-Belt line of power transmission and material-handling equipment, including elevating and conveying chains, elevator buckets, sprocket wheels, chain drives, power transmission machinery, variable-speed transmission units, belt conveyors, etc. In addition to the catalogue material, the book contains much practical information on the mechanical conveying and preparation of materials, and the transmission of power, and includes engineering data that should be useful to the designing engineer and the buyer alike.

## Band Saws and Hacksaws

HENRY DISSTON & SONS, INC., 625 Tacony, Philadelphia, Pa. Loose-leaf bulletins containing information on the selection and care of metal-cutting band saws and hacksaw blades, respectively. The pamphlet on band saws contains, among other useful data, recommended speeds for cutting various classes of materials with hard edge metal-cutting band saws of different numbers of teeth. The bulletin on hacksaw blades tells how to select the proper length, width, thickness, etc., of saw blade, and recommends the most suitable blades for cutting different materials and classes of work.

## Welding Rods

AMERICAN BRASS CO., Waterbury, Conn. Catalogue B-13, containing data on Anaconda welding rods for gas and electric welding. This booklet gives detailed information on the welding properties, melting points, weight and strength data, method of procedure, and the individual characteristics of each of the fourteen different Anaconda welding rods. The oxy-acetylene gas torch, electric carbon arc, metallic arc, and carbon arc torch methods of welding with copper alloy welding rods are also described and illustrated.

***Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.***

## Stainless Steel

REPUBLIC STEEL CORPORATION, Youngstown, Ohio. Bulletin 125, containing data on Enduro 18-8 stainless steel. Information is given on the physical properties, as well as on the fabrication of the various types of steels included in the 18-8 series. An important feature of the booklet is a table of laboratory corrosion data, listing the degree of corrosion resistance of Enduro stainless steels to more than 300 chemical reagents, solutions, and products under varying conditions of temperature and concentration.

## "Galvannealed" Sheets

REPUBLIC STEEL CORPORATION, Youngstown, Ohio. Bulletin 120, containing information on Republic "Galvannealed" sheets. The folder explains the metallurgical reasons for the superior adherence of the zinc coating on these sheets and describes their characteristics. A large number of recommended applications are listed. In addition, a table is given on the gages and sizes in which these sheets are furnished, and tables of size extras and gage differentials are included.

## Grinding Machines

NORTON CO., Worcester, Mass. Circular illustrating and describing the Norton 6- by 18-inch hydraulic surface grinder, designed for light manufacturing jobs where small parts with flat accurate surfaces must be produced on a production basis. Circular illustrating and describing the Norton No. 1 universal tool and cutter grinder, designed to meet the needs of the modern toolroom. Complete specifications of both machines are given in these circulars.

## Air-Operated Valves

C. B. HUNT & SON, Salem, Ohio. Bulletin 101-V, outlining the principle of construction of the "Quick-As-Wink" air valves, which are so designed as to eliminate metal-to-metal wear and provide a progressively tighter seal as the air pressure becomes greater. The advantages of these valves are pointed out, and engineering data of value in figuring applications of these units are given.

## Gears and Speed Reducers

CHARLES BOND CO., 617 Arch St., Philadelphia, Pa. Catalogue 57, listing this company's complete line of stock gears, which includes thousands of sizes, as well as the Bond line of stock speed reducers from fractional sizes to 5 horsepower. Valuable engineering data, such as rules and formulas for gear sizes, strength of gear teeth, horsepower of gear teeth, etc., are included.

## Pneumatic Tools

INGERSOLL-RAND CO., 11 Broadway, New York City. Catalogue 12100, covering the complete line of Ingersoll-Rand pneumatic tools and appliances, together with the principal accessories used. The tools covered include pneumatic drills, wrenches, and grinders; "Safety First" air saws; riveting and chipping hammers; air motor hoists; stationary motors; etc.

## Pumps, Air Compressors, Engines, etc.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Circular listing the complete line of Worthington products, which includes air compressors, refrigeration equipment, rock drilling equipment, contractors' air tools, Diesel engines, gas engines, multi V-drives, feedwater heaters, steam condensers, pumps, and meters.

## Stainless Steel

AMERICAN SHEET & TIN PLATE Co., Pittsburgh, Pa., and EDWARD G. BUDD MFG. Co., Philadelphia, Pa. Pamphlet entitled "The Burlington Zephyr—America's First Diesel All-Steel Streamlined Train," illustrating and describing this remarkable achievement in railway development and calling attention to the use of stainless steel in its construction.

## Motors

LINCOLN ELECTRIC Co., Cleveland, Ohio. Bulletin illustrating and describing "Linc-Weld" self-protecting motors, which are so designed as to provide automatic protection against overheating. Frame sizes are given for different sizes of motors, ranging from 1/2 to 50 horsepower, operating at speeds of from 450 to 3600 revolutions per minute.

## Air Compressors and Vacuum Pumps

INGERSOLL-RAND Co., 11 Broadway, New York City. Catalogue 7502-C, containing information on Ingersoll-Rand industrial compressors and vacuum pumps, including suggestions for selecting the proper compressor, a description of the mechanical features, and a list of industrial applications. Price lists are given.

## Ball Bearings

FAFNIR BEARING Co., New Britain, Conn. Pamphlet containing information on the lubrication of ball bearings, with particular reference to the "oil versus grease" problem. Ball bearing users who are interested in securing the best lubrication for this type of equipment will find much valuable information in this little pamphlet.

## Air Compressors

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Circular illustrating and describing Worthington horizontal, single type, refrigeration compressors equipped with feather valves.

Circular entitled "Compressed Air at Lower Cost," listing the advantages of Worthington feather valve compressors.

## Portable Electrical Instruments

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Catalogue 43-120, illustrating and describing Type Px-5 portable electrical instruments for general testing, laboratory or research work. Information is given on the application, construction, and operation of these instruments, and list prices are included.

## Welding Equipment

LINCOLN ELECTRIC Co., Cleveland, Ohio. Leaflet descriptive of the "Lincontrol," a remote control device for controlling welding current in cases where the welder cannot be placed within easy reach of the operator. The advantages of this equipment are pointed out, and the operation is described and illustrated.

## Projection Apparatus

R. Y. FERNER Co., 930 Investment Bldg., Washington, D. C. (American agent of the Societe Genevoise d'Instruments de Physique). Catalogue 577, describing a desk type projection apparatus for the easy inspection, measurement, and photography of small manufactured articles and various types of materials.

## Self-Opening Die-Heads

EASTERN MACHINE SCREW CORPORATION, 23-21 Barclay St., New Haven, Conn. Bulletin illustrating and describing the features of construction of the H & G general-purpose self-opening die-heads. Tables giving dimensions and range diameters of the various sizes and styles are included.

## V-Belt Drives

L. H. GILMER Co., Tacony, Philadelphia, Pa. Engineering bulletin containing data on the multiple-drive V-belts made by this company. The bulletin emphasizes the necessity of measuring belt lengths under full load, and describes the precautions taken to insure perfectly matched belts in a set.

## Welding Equipment

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Leaflet 20615, descriptive of a new line of spot and projection welding equipment for manual or motor operation. The publication describes the distinctive features, construction, operation, and application of this equipment.

## Indicating and Recording Instruments

ESTERLINE-ANGUS Co., Indianapolis, Ind. Bulletin entitled "The Graphic," descriptive of the use of Esterline-Angus graphic instruments for recording the cycle of the welding current and other conditions in spot-, seam-, and arc-welding operations.

## Power Transmission Equipment

BOSTON GEAR WORKS, INC., Dept. M, North Quincy, Mass. Catalogue 50, giving dimensions, price lists, and other data covering the complete line of power-transmitting equipment made by the concern, which includes gears, speed reducers, chain drives, ball bearings, etc.

## Material-Handling Equipment

C. O. BARTLETT & SNOW Co., Cleveland, Ohio. Bulletin 72, containing a complete description of the various types of Bartlett-Snow belt idlers, together with tables of dimensions, prices, etc., and engineering data relative to the proper spacing, capacities, and angles of incline.

## Cold-Drawn Steel

UNION DRAWN STEEL Co., Massillon, Ohio. Circular descriptive of the many applications of cold-drawn squares and flats. The circular includes a table of standard manufacturing tolerances for cold-drawn squares and flats containing 0.50 per cent carbon and less.

## Electric Furnaces

HEVI DUTY ELECTRIC Co., Milwaukee, Wis. Bulletin HD-334, entitled "Outstanding Achievements in Electric Furnace Designs," illustrating typical examples of the Hevi Duty line of electric heat-treating furnaces for the laboratory, tool-room, and production line.

## Vulco Ropes

GATES RUBBER Co., Denver, Colo. Circular containing samples of two types of cotton cord—one the ordinary dry cord, and the other a cord that has been soaked in pure liquid rubber, which is used in making Vulco rope, and is said to greatly increase the life.

## Air Compressors

GARDNER-DENVER Co., Quincy, Ill. Bulletin AC-7, descriptive of this company's line of air-cooled compressors. New prices are given in this bulletin. Bulletin HAC-36, illustrating and describing Gardner-Denver duplex two-stage horizontal compressors.

## Indicating, Recording, and Controlling Instruments

BROWN INSTRUMENT Co., Philadelphia, Pa. Folder 85-10 entitled "Here's Real Evidence of Improved Quality through Better Temperature Regulation," illustrating the importance of automatic temperature control.

## Protective Helmets

W. W. SLY MFG. Co., 4704 Train Ave., Cleveland, Ohio. Bulletin S-68,

descriptive of the Purair helmet, which is equipped with an air filter and purifier for protecting those engaged in blast-cleaning, welding, and similar operations, from fumes, grit, dust, etc.

### Thermometers

BROWN INSTRUMENT CO., Philadelphia, Pa. Catalogue 9001, illustrating and describing Brown resistance thermometers, made in indicating, recording, and controlling types, for measuring temperatures from minus 300 degrees to plus 1000 degrees F.

### Welding Rod

AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill. Bulletin 1, containing suggestions for welding, using Amsco nickel-manganese steel welding rod. Bulletin 2, containing suggestions for welding, using No. 459 hard-surfacing welding rod.

### Magnesium Alloys

DOW CHEMICAL CO., Midland, Mich. Dowmetal Data Book, covering the properties, specifications, available forms, uses, design, fabrication, welding, methods of finishing, etc., of Dowmetal alloys—a group of magnesium-base alloys.

### Testing Equipment, Instruments, Etc.

ARTHUR JACKSON MACHINE TOOL CO., 9 Front St., E., Toronto 2, Ont., Canada. Catalogue of testing equipment, stop-watches, and other instruments for personal, industrial, and scientific purposes.

### Rustproofing Processes

PARKER RUSTPROOF CO., Detroit, Mich. Bulletin entitled "A Common Cause of Paint Failure and Its Scientific Prevention," outlining the application of the Parker processes for protecting iron and steel products from corrosion.

### Die Steel

FIRTH-STERLING STEEL CO., McKeesport, Pa. Folder containing information on Cromovan triple die steel for high production. The circular covers analysis, properties, characteristics, heat-treatment, and applications.

### Electric Welding Machines

THOMSON-GIBB ELECTRIC WELDING CO., Lynn, Mass. Circular illustrating and describing the Thomson-Gibb multiple flash welder, which makes four welds simultaneously, and three other designs of flash-welding machines.

### Electric Equipment

GENERAL ELECTRIC CO., 10 Canal St., Schenectady, N. Y. Bulletin GEA-1607A, illustrating and describing Type B direct-current generators and exciters for general-purpose service and for field excitation.

### Electric Motors

WAGNER ELECTRIC CORPORATION, 6467 Plymouth Ave., St. Louis, Mo. Bulletin 167, illustrating and describing Type RD direct-current motors —their construction details, operation, application, ratings, etc.

### Electric Hoists and Cranes

ROBBINS & MYERS, INC., Springfield, Ohio. Bulletin 5092, containing illustrations showing the details of construction of R & M electric hoists and cranes. Complete specifications and price lists are included.

### Electric Furnaces

HAROLD E. TRENT CO., 618 N. 54th St., Philadelphia, Pa. Leaflet TD-20, containing data on Trent pot and trough type electric furnaces for continuous service and temperatures up to 1700 degrees F.

### Wrenches

BONNEY FORGE & TOOL WORKS, Allentown, Pa. Catalogue 34A, illustrating and describing the Bonney complete line of open-end, box, socket, pipe, and special wrenches for hand or power use.

### Roll Polishers

STREINE TOOL & MFG. CO., New Bremen, Ohio. Folder illustrating and describing the design and operation of the Wahlert automatic self-cleaning roll polisher for steel- and sheet-mill rolls.

### Wire Products

FIRTH-STERLING STEEL CO., McKeesport, Pa. Circular describing the Globe wire products, which include high-speed steels, tool steels, and stainless steels in bar, rod, and wire form.

### Explosion-Proof Condulets

CROUSE-HINDS CO., Syracuse, N. Y. Bulletin 2282, containing tables of dimensions and prices covering the company's complete line of explosion-proof condulets.

### Synthetic Plastics

GENERAL PLASTICS, INC., North Tonawanda, N. Y. Bulletin on Durez molding compounds, describing the properties, advantages, and applications of these materials.

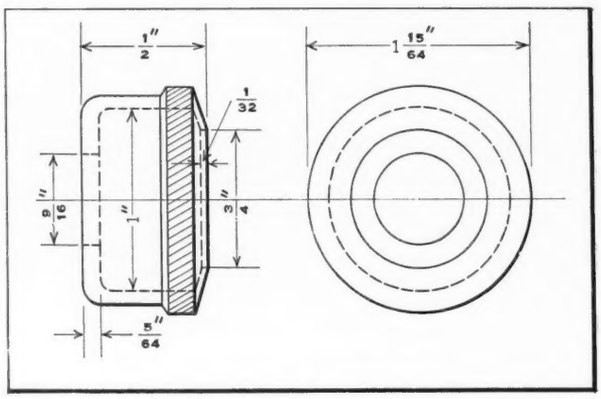
### Ball-Bearing Lubricants

ACHESON COLLOIDS CORPORATION, Port Huron, Mich. Technical bulletin No. P 182, dealing with the use of colloidal-graphited lubricants in ball bearings.

### Flexible Couplings

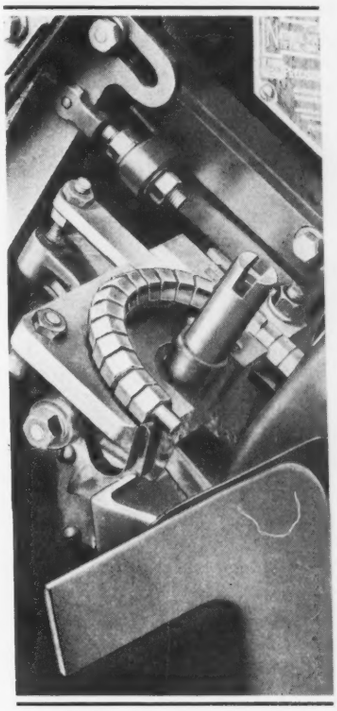
D. O. JAMES MFG. CO., 1114 W. Monroe St., Chicago, Ill. Circular describing the construction and advantages of the D. O. James flexible coupling.

The Part Shown in These Two Illustrations is Made in Eighteen Seconds. It is a Steel Ball-bearing Race for Roller Skates and is Produced Complete in One Machine Set-up. How the Part is Made will be Described in an Article to be Published in July MACHINERY.



# *Shop Equipment News*

*Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market*



## National Precision Nut Tappers

Nuts of Class 3 and 4 fits are tapped on a commercial basis in machines of a new precision line now being introduced on the market by the National Machinery Co., Tiffin, Ohio. These machines are ball bearing throughout, and all working parts run in an oil bath to insure accuracy of the machine functions. Adjustments have been provided to permit accurate positioning of the tap and a close control of the feed.

The "hook" tap employed possesses the advantage of the common bent tap and in addition, it can be kept accurately positioned. The heading illustration shows the tap in the machine, filled with nuts, as in an actual operation. The tap-holder was removed when the picture was taken in order to show the tap. Accurate alignment of the tap, together with its floating action, has made tapping to close tolerances possible on a production basis. Another advantage claimed for these taps is that they are freer from breakage than the old type of bent tap with a right-angle shank.

Fig. 1. Precision Nut-tapping Machine Brought out by the National Machinery Co.

A full view of one of these machines is shown in Fig. 1. The hopper is of an improved design that turns the nuts as they are delivered to the chute so that they are presented to the tap with the bottom face against the injector. This insures that the nuts are tapped square with the bottom face.

An improved lubricating and cooling system materially reduces the temperature of the coolant and thereby increases tap life. The effectiveness of the lubrication is such that the nuts are discharged entirely free from chips.

The machines of this line are electrically driven and are fully protected by automatic

safety devices. These devices operate an electric brake and stop the machine almost instantaneously without over-run, another feature that reduces the breakage of taps. When the machine stops, a tell-tale light signals the operator. The machines are furnished complete with the motor and all the electrical equipment.

These machines are built in a full range of sizes for tapping nuts from 1/4 to 1 inch, both hexagonal and square. Arrangements can also be made for tapping Dardelet nuts.

## Electrode of High Tensile Strength

Welds with tensile strengths of from 85,000 to 100,000 pounds per square inch can be made with an arc-welding electrode known as "Shield-Arc Eighty-Five," which has just been placed on the market by the Lincoln Electric Co., Cleveland, Ohio. Welds made on steels of high tensile strength with this electrode have shown an elongation of from 15 to 20 per cent in two inches.

This electrode is particularly suitable for welding low-alloy structural steels which, on normalizing, have tensile strengths under 100,000 pounds per square inch. Steels in this group would include Cromansil, low-carbon nickel steels, structural silicon steels, low-carbon manganese steels, vanadium steels, and in general, all low-alloy steels having less than 0.30 per cent carbon.

This electrode is suitable for flat, vertical, or overhead welding. It is available in diameters of 5/32 and 3/16 inch.

## Lipe High-Speed Gear-Tooth Chamfering Machine

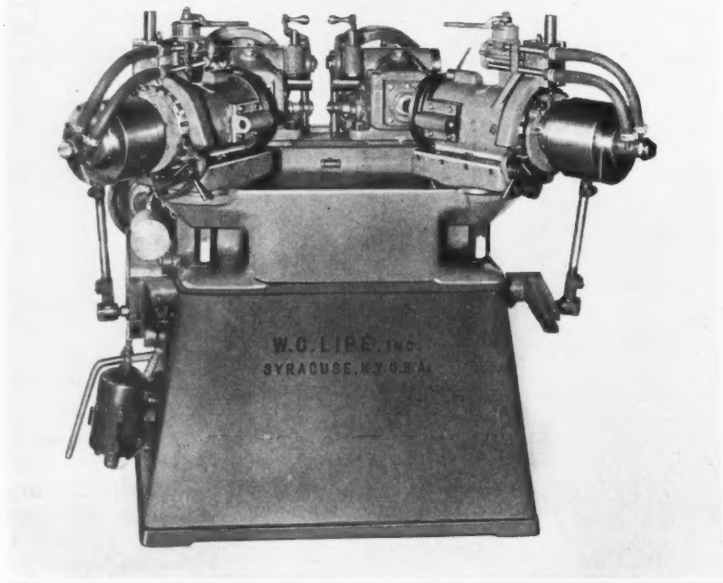
Gear teeth can be chamfered at speeds up to 150 teeth per minute in a machine recently developed by W. C. Lipe, Inc., Syracuse, N. Y. This machine operates on the same principle as the chamfering machine made by the company for many years, but it incorporates a new high-speed indexing method. The working parts have been strengthened and redesigned in keeping with the high speeds that are now obtainable. New feed- and index-cams provide a much smoother action than before and a better finish of the work.

The cutter-spindle is mounted in preloaded ball bearings. The square sleeve in which the spindle rotates has been increased in size to provide longer wear and greater rigidity. The rack and pinion which drive the square sleeve are made of heat-treated steel. The rack can be turned end for end as wear occurs or it can be changed without replacing the sleeve.

The worm-feed carriage for the work-head is designed for rapid and accurate adjustment of the work in setting up the machine. Precision scales facilitate accurate adjustments. The worm-feed carriage is equipped with a vernier dial, in addition to scales. Hardened index-plates with ground teeth insure accurate indexing.

The increased speed of operation also necessitated redesigning the worm drive. The worm is now ball-bearing mounted and its housing has been changed to provide accessibility and to eliminate leakage of oil. The base of the machine has been enclosed. Foot-controlled air valves can be supplied as optional equipment when maximum speed of operation is desired.

All kinds of gears and pinions, including spur, helical, internal, intermittent, and spiral-bevel, can be chamfered. The machine will also chamfer splines, cut back intermittent teeth, and perform drilling. Single- and double-spindle models are built, and there is also a special model that is adapted for chamfering flywheel ring gears.




Lipe Heavy-duty Gear Chamfering Machine which Runs at High Speed

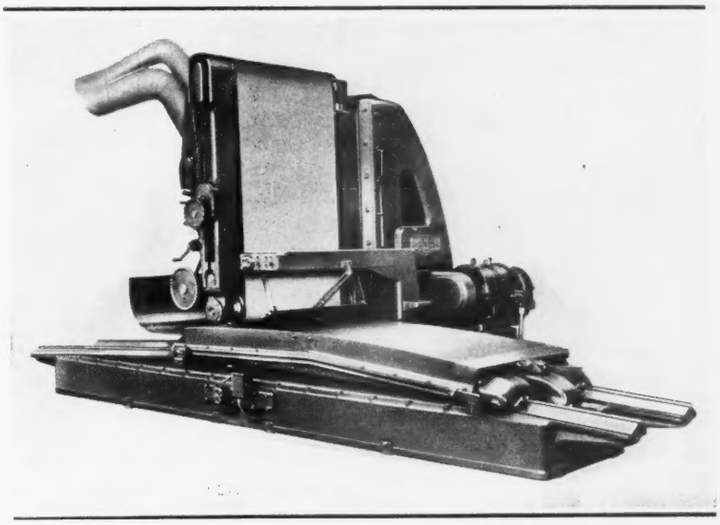
## Homo Tempering Furnace for Small Parts

A Homo tempering furnace designed especially for handling heavy, dense loads of small articles has recently been introduced on the market by the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. With this furnace, small bolts, rivets, or

other parts can be tumbled directly into the work basket without distributing them on trays, and yet the parts are heat-treated uniformly throughout the load. This method has enabled production to be increased as much as three or four times.

In this furnace, a fan of new design pulls large amounts of heated air through the dense work at high speed. Thus, parts at the bottom of the basket are heated to the same temperature and at the same rate as parts at the middle, top, and sides of the basket. This furnace has the same characteristics as other Homo furnaces—for example, automatic control.

Temperature-exploration charts have been made from heats carried out under actual production conditions in order to check the uniformity of results. In one of these tests, eight pre-checked thermo-couples were distributed at various points throughout an 800-pound load of 1/4- by 3/4-inch rivets which had been emptied into a 25- by 19-inch work basket. The charts showed that the load came up to temperature evenly, did not go beyond the control point, and remained close to the holding temperature. These rivets were heat-treated at the rate of 960 pounds an hour, while 3- by 3/8-inch bolts were handled at the rate of 1100 pounds an hour.



Mattison Reciprocating Type of Machine with an Abrasive Belt for Grinding Wide Sheets

## Mattison Abrasive-Belt Sheet-Grinders

Sheets of alloy and carbon steels or other materials can be finished in two new types of grinding machines recently developed by the Mattison Machine Works, Rockford, Ill. Factory-coated abrasive belts, wider than the sheets being handled, do the grinding. The machines have been designed to insure freedom from chatter or vibration and to give the desired accuracy.

One of the models is equipped with a roll feed. This machine is designed for superficial or rough grinding, when one pass of the work under the abrasive belt is sufficient to clean the sheet to the desired extent. This model also lends itself to tandem operation, where a number of units are set up in line and the stock passes progressively from one unit to the next.

The second model, which is the one illustrated, has a reciprocating table and is designed for the finer finishing operations which require more than one pass of the sheet under the abrasive belt. The thin sheets being ground rest on the curved surface of the table and are so flexed that buckles are evened out. A flat cross-section is always presented to the grinding belt.

Since the sheet is flexed in the opposite direction to the curve of the grinding roll, the abrasive grain of the belt penetrates well into the surface of the metal and a good cutting action results. There is only a short contact between the abrasive belt and the work so that long scratches are prevented.

The main arm of the machine, which carries the abrasive belt and the driving and idler rolls, is adjustable vertically as one unit on the column to suit different thicknesses of material and for setting to the cut. The belt can be quickly replaced, it being unnecessary to remove bearings or other parts for this purpose. Standard sizes or both machines carry belts up to 50 inches wide for grinding sheets up to 48 inches in width and of any length.

## Multi-Purpose Sealing Compound

A compound has been placed on the market by the Ideal Commutator Dresser Co., Industrial Division, Sycamore, Ill., that can be used as a sealing agent against air, gas, fuel oil, etc.; as a rust preventive on screw threads, turnbuckles, etc.; as a belt dressing; as a lubricant on universal joints, pumps, etc.; and as a corrosion preventive on electrical connections or parts that come in contact with acid.

This compound, which is called "Ideal Perfect Seal," is non-soluble, non-corrosive, and non-oxidizing. It comes in paste form and can be spread as thin as 0.001 inch. It is said to seal instantly and yet never to harden or become brittle. The compound is unaffected by atmospheric conditions and resists heat up to 400 degrees F. It is supplied in 3- and 8-ounce tubes, 4-pound pails, and 45- and 135-pound drums.

## Littell Self-Centering Stock Reel

Coils of stock up to 48 inches outside diameter and up to about 400 pounds in weight can be handled by a No. 3 reel recently added to the line of the F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill. Like the larger capacity No. 5 reel described in MACHINERY, June, 1931, page 815, the new reel is equipped with arms that automatically center the coil. This is accomplished after a coil has been slid on the arms, by merely turning the reel like a capstan until the arms have fed radially a sufficient amount to hold the coil firmly from the inside.

With this construction, the coil is properly balanced, regardless of whether it is large or small, a feature that is of considerable importance in view of the fact that most reels are used in conjunction with automatic feeds and must therefore have a uniform rotation. The coil keepers or holders are instantly removed for reloading and as quickly mounted in place after a coil has been loaded on the arms. There is a holding device on which the keepers are placed for convenience during loading.

Another feature of the new reel is a quick-loading lever, by means of which heavy coils can be readily loaded by one man. For this operation, the arms are contracted toward the center of the reel and the spider is locked to prevent rotation. The loading lever is then passed through the coil of stock and anchored to the upper arm by means of a pin. Sufficient leverage is obtained in this manner to easily lift the coil and slide it on the reel. The lever reduces the time of loading and centering the coil to within one minute.

A stock support arm at the bottom of the reel permits running with a loose loop without danger of the stock becoming tangled with the reel arms. A motor drive can be furnished for the reel.

## Globe Tilting Tumbling Barrels

Based on twenty-seven years of experience as a manufacturer of tumbling and burnishing barrels, the Globe Machine & Stamping Co., 1200-1250 W. 76th St., Cleveland, Ohio, has brought out an entirely redesigned line of tilting barrels. One of the important features of the new line is a patented work-shifting bottom. As the work is rotated, this one-piece casting also moves it forward and backward, thus giving a triple action for which high-speed of operation and uniformity of finish are claimed.

Five roller bearings are provided to minimize wear. Two of these are supplied for the bevel pinion, one for the driving pulley and two for the shell or barrel supporting shaft. Grease cups feed lubricant to extra large pockets around the bearings and shafts, thus insuring smooth operation, minimum power consumption, and durability.

The pulleys are of a continuous web construction which eliminates the possibility of pulley breakage, sometimes caused by overloading machines. The base, stand, gear guard, pulleys and shifter bracket are constructed to give maximum rigidity under severe working conditions. This tumbling barrel is built in five sizes to meet various needs.

Easy Loading is a Feature of the Latest Littell Automatic Centering Stock Reel

Globe Tilting Barrel with a Bottom that Imparts a Triple Movement to the Work

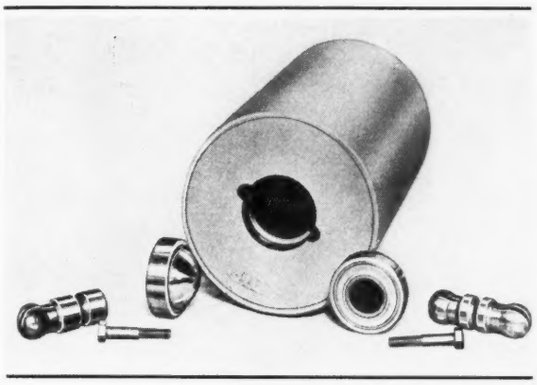
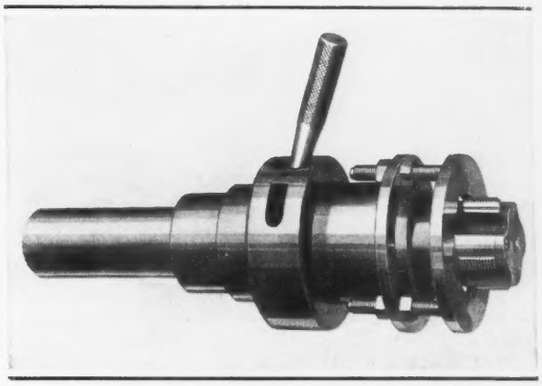


Fig. 1. Conveyor Roll and New Departure Sealed Ball Bearing



Murchey Collapsible Tap which can be Used for Both Rotary or Stationary Work

## Conveyor-Roll and Mine-Car Wheel Bearings

Self-enclosed ball bearings filled with sufficient lubricant to last throughout their life and permanently sealed have been placed on the market by the New Departure Mfg. Co., Bristol, Conn., for application to conveyor rolls and to the wheels of mine cars. The parts that make up the conveyor-roll bearing are illustrated in Fig. 1, together with a conveyor roll. The manner in which these parts are assembled will be apparent from the left-hand view of Fig. 2.

Conveyor rolls designed for these bearings are easily assembled. After brackets have been mounted to support a conveyor roll, the stub shaft is pushed through the roll until both ball ends seat in the spherical ends of the ball bearings. Then locking bolts are inserted and tightened. No misalignment or excessive thrust loads are possible. After the ball bearings have been mounted, a waterproof compound is used to plug up the puller holes in the rolls, so as to keep out water and dirt.

There are two rows of balls in the mine-car wheel bearing, as will be seen from the right-hand diagram in Fig. 2. These rows are spaced wide apart and the balls are preloaded with a view to giving an unusually high degree of rigidity. An effective seal for the lubricant is provided on both sides of the bearing. Because of the width of the inner and outer rings, the fit on the axle and in the wheel may be fairly loose. A worn wheel can be quickly replaced by removing three nuts, without disturbing the bearing or permitting dirt to enter the balls or races.

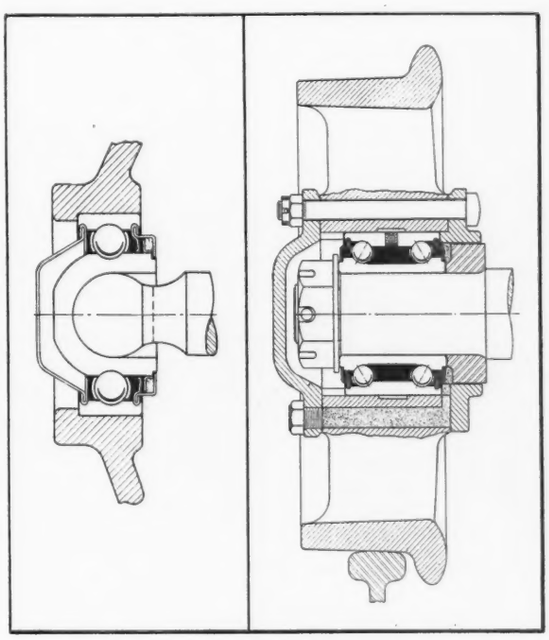


Fig. 2. Assemblies of Conveyor Roll and Mine-car Wheel Bearings

## Collapsible Taps for Rotating or Stationary Work

One of the features of a line of Type C collapsible taps being placed on the market by the Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich., for both machine and pipe threads is that the same taps can be used for both rotating and non-rotating work by merely inserting or removing a handle. Hence, the same taps are applicable to hand screw machines, turret lathes, drilling machines, and similar machines.

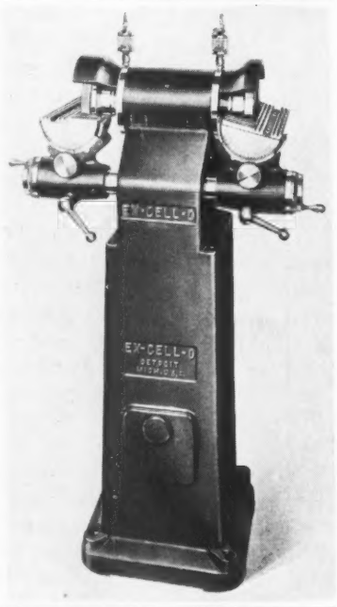
Another feature of the new line is that the taps are automatically collapsed after a thread has been cut to the desired length, by the engagement of rollers with a cam. This design eliminates any chance of the chasers binding due to friction as they collapse or recede, the chasers being positively collapsed in T-slots of a hardened and ground center pin. The chasers of non-rotating taps are expanded by the handle coming in contact with a stop on the machine. With rotating taps, a sliding collar comes in contact with the stop. The chasers can be removed without taking off the cap.

Internal adjustment of the chasers is made from the front end of the tap. After an adjustment, the center pin is locked to insure permanence of the setting. The adjustment allows for 3/64 inch above or below normal chaser size, so that over-size or under-size threads can be cut and compensation made for regrinding chasers. Overhung chasers can be provided for cutting close to shoulders or for use in blind holes. Boring, reaming, and chamfering tools can be incorporated with the chasers, and various pilots can be supplied.

These taps are made in twelve standard sizes for cutting machine threads from 1 1/4 to 5 1/2 inches, and pipe threads from 1 to 4 1/2 inches.

## Ex-Cell-O Floor Type Grinding and Lapping Machine

A floor type machine for grinding and lapping cemented-carbide tipped tools has been placed on the market by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. Except for the column, this machine is of the same general construction as the bench type tool-sharpening machine described in November, 1932, MACHINERY, page 231. A new feature, however, is the use of hardened and ground strips on the top surface of both tables. These strips reduce wear on the tables and make it easy to keep them clean while the machine is in operation.



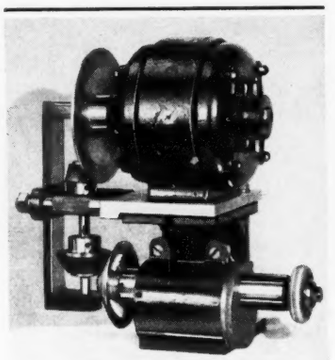

Ex-Cell-O Grinding and Lapping Machine of Floor Type

The tables are U-shaped, extending past both ends of each wheel and along the front. They have a horizontal micrometer adjustment. Two of the hardened and ground strips are mounted parallel with the face of each wheel. These strips form a slot which acts as a guide for the tool support. Across the ends of each table and in front of the wheel are mounted two other hardened and ground strips. U-shaped slots are machined lengthwise in all strips.

Both wheels are driven by an inbuilt motor, equipped with a shaft projecting from the two ends. The motor is rated at 3/4 horsepower and runs at 3450 revolutions per minute. A ring type grinding wheel, 6 inches in diameter, with a 1 3/4-inch grinding surface on the side, is used at one end of the motor, while a 6-inch iron lapping disk provided with a 1 3/4-inch lapping surface on the front and a 3/4-inch lapping surface on the back, is mounted on the opposite end of the motor shaft.

## Toolpost Grinder with Friction Drive

Smooth running is obtained by means of a friction drive in a toolpost grinder recently placed on the market by Julius Merey, who is connected with the Chicago Tool & Stamping Co., 225 W. Huron St., Chicago, Ill. Power is transmitted from the motor to the grinding spindle by an aluminum friction plate, two friction pulleys having facings of



Toolpost Grinder Driven through Friction Pulleys

leather combined with paper, and a small aluminum pulley. Various speeds up to 21,000 revolutions per minute can be obtained by simply changing the positions of the leather friction pulleys.

The cast-iron base of this grinder can be conveniently attached to a lathe or other machine tool. The grinding spindle revolves in an eccentric bushing that provides for height adjustment to suit different machines. Two double-row ball bearings are furnished for the grinding spindle. The bushing is filled with a graphite grease and does not require other lubrication for a long time. Graduations facilitate accurate settings of the eccentric bushing.

Grinding wheels up to 4 inches in diameter can be used for external grinding, and there are two extensions that adapt the equipment for internal grinding. The motor is of 1/4 horsepower rating and is equipped with ball bearings. The vertical shaft also runs in ball bearings, and is mounted on an aluminum bracket.

## Poole Improved Flexible Couplings

The all-metal flexible couplings of the Poole Foundry & Machine Co., 3701 Clipper Mill Road, Woodberry, Baltimore, Md., have been made in the past with end plates welded to both floating sleeves. These sleeves are now of a one-piece construction which

eliminates the warpage formerly caused by the heat of the welding operation. A much closer tolerance can be maintained at the bearing points because of the sleeves being true as to roundness. A lighter and smoother construction is also claimed for these couplings.

The general design of these couplings was described in MACHINERY, December, 1930, page 318, and December, 1929, page 341.

## Blueprinter with Mercury Vapor Tube Lamps

Three General Electric mercury vapor tube lamps are provided on the Model E blueprinter recently added to the line of the Shaw Blue Print Machine Co., Inc., 9-11 Campbell St., Newark, N. J. With lamps of this type, carbons or globes are not required, and the equipment is always ready for use. These lamps are especially adapted for producing black and white prints direct from tracings, and they give uniform results.

The machine is of the horizontal continuous type. Tracings are fed on a continuous roll of sensitized paper or on sheets of the paper precut to the required dimensions. The tracings are returned to the operator at the front of the equipment.

Power for driving the endless canvas band that carries the tracings and sensitized paper through the machine is supplied by a 1/6-horsepower motor. A speed control at the right-hand end of the machine provides selective speeds from 6 inches to 5 feet a minute. There are independent snap switches for each lamp and for the motor.

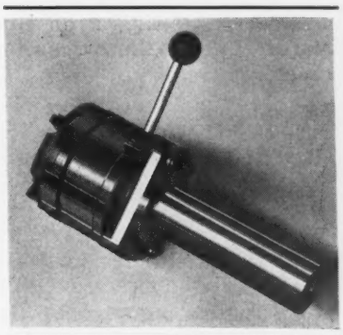
In addition to white and black prints, the machine will produce blueprints, Van Dyke negatives, blue-line and Ozalid prints.

Shaw Blueprinter Equipped with Mercury Vapor Tube Lamps

## Jones & Lamson Stationary Tangent Dies

A line of stationary tangent dies has recently been brought out by the Jones & Lamson Machine Co., Springfield, Vt. These dies are of the pull-off type and possess several features in addition to those embodied in the J & L revolving tangent dies that have been on the market since 1929. The dovetail surfaces of both the chaser-holders and the die-body slots are hardened and ground. The holders can be changed, if necessary, without disassembling the die.

The new dies are locked by pushing the lever handle in one direction, and tripped by pushing the handle in the opposite direction. For making pitch diameter adjustments, a spring-operated pawl is raised out of engagement with the teeth of an adjusting nut. The nut is then moved into the desired position, after which the pawl is again engaged with the teeth of the nut for locking the setting. Adjustments to 0.00025 inch are made by means of the nut and pawl. In addition, the periphery of the die plate adjacent to the nut is provided with wide-spaced graduations that enable settings to be made to 0.001 inch.



Stationary Tangent Die with Longitudinal and Eccentric Float

Two springs set to a predetermined pressure supply a cushioning action in starting to cut a thread, thus eliminating a solid impact between the chaser and the work. The dies are also provided with longitudinal float, so that the chasers can reproduce threads to their own accuracy. The driving flange is screwed on the shank and doweled in place, providing a drive at a point farthest from the center of the die. This arrangement permits an eccentric float that takes care of misalignment between the die and the work. The amount of eccentric float is determined by the clearance allowed between a shank that is integral with the die body and the bore of the shank sleeve.

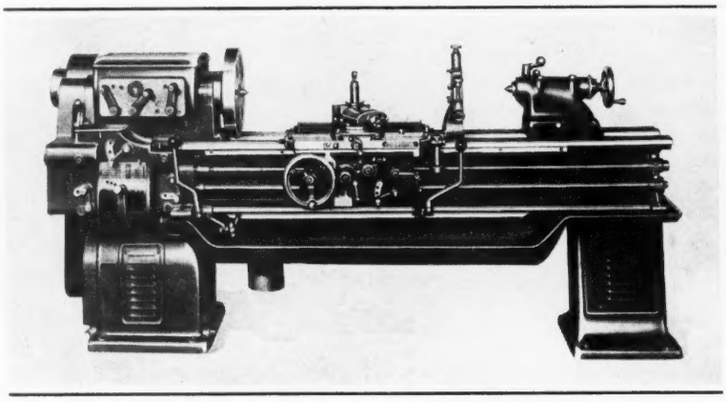
The chasers for these dies are ground to the correct helix angle for the diameter and pitch of the thread to be cut. All chasers are interchangeable in revolving and stationary dies of the same capacity. Only one set of chaser-holders is necessary for any right-hand threads within the rated capacity, whether special or standard and regardless of diameter and pitch. These stationary tangent dies are available

in five sizes covering a range of from No. 8–32 to 2-inch diameter threads.

## Hart Plunger-Operated Mercury Tube Switch

A mercury tube switch so designed that it can be made to close or break an electric circuit by the action imparted to its plunger through cams, levers, or gears, has been produced by the Hart Mfg. Co., Hartford, Conn. This automatically operated switch is intended for controlling different movements of a machine, and it can also be used for stopping motors during or upon the completion of an operation. Another use is as a limit switch in connection with motor-operated doors.

The plunger may be located to operate from the sides or top of the case. The switch can also be supplied without the plunger, if desired, for operation on the rocker principle.



Sidney Lathe which Provides Twelve Speed Changes through Sliding Spur Gears

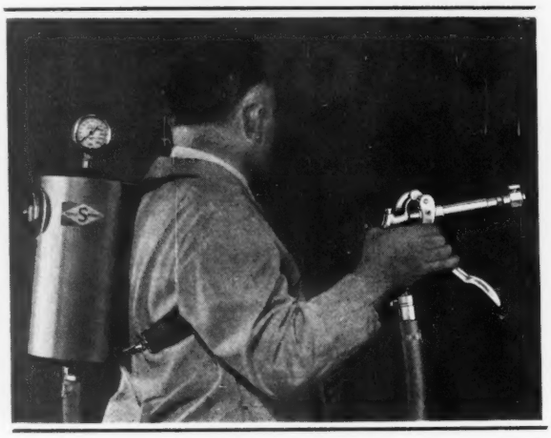
## Sidney Twelve-Speed Sliding Gear Lathe

Twelve speeds ranging from 14 to 534 revolutions per minute are obtained through sliding spur gears of heat-treated alloy steel in 14- and 16-inch heavy-duty lathes recently added to the line of the Sidney Machine Tool Co., Sidney, Ohio. These speeds are obtained without the use of jaw clutches. The gears slide on ground shafts of heat-treated alloy steel which are provided with multiple splines. Automatic lubrication for the headstock is provided by a combination pump and spray system. Filtered oil is delivered to the headstock by individual copper lines. The headstock and its cover form an oil-tight case.

The driving clutch for the headstock is of the multiple disk type. It is mounted in a housing that is bolted to the headstock proper, where it is readily accessible for adjustment. Starting and stopping of the spindle are effected through two levers, one in the headstock and the other in the carriage apron. These levers control both the clutch and a brake that stops the spindle instantly.

Except for the differences in the headstock and in the height and width of the bed, these machines are identical with the sixteen-speed Tritrol lathe which has been built by the company for several years. Driven shafts, all intermediate shafts, and the spindle are mounted in Timken precision roller bearings. The lead-screw is made from Cumberland turned and ground stock.

The quick-change gear mechanism provides a range of forty-eight thread and feed changes without the use of additional gears. Threads can be cut from 1 1/2 to 92 per inch, including 11 1/2 per inch. Feeds are obtainable from 0.0027 to 0.172 inch per spindle revolution.



Grease Gun Outfit Pre-charged with Air for Convenient Lubrication

## Air-Operated Industrial Grease Guns

Portable grease-gun outfits that include a ten-pound tank which may be suspended to the user's back or mounted on a low stand are being introduced on the market by the Specialty Sales & Service Corporation, 138 Holden St., Minneapolis, Minn. The tank is filled about three-quarters full of grease and then charged with air at a pressure of from 100 to 125 pounds per square inch.

The grease can then be conveniently fed to equipment by operating a handle which builds up pressure in a piston chamber and forces the grease from the end of the gun head. It is said that ample pressure is developed to force lubricant into the tightest bearings. High-, medium-, and low-pressure

heads can be supplied to suit requirements in individual plants.

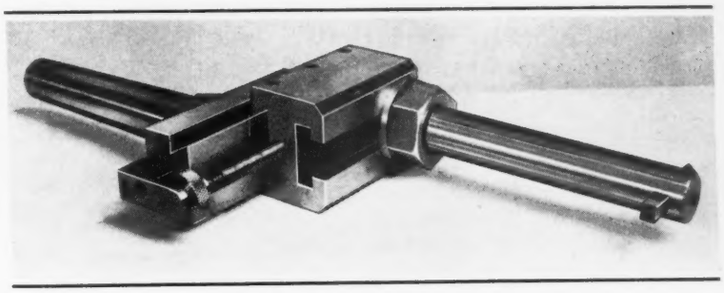
Tanks can be supplied on casters for pulling on the floor. A two-compartment tank is made for handling high-pressure lubricant and volume grease.

## Russell Adjustable Boring-Bar

Holes from 9/16 inch to 12 inches in diameter can be bored by means of the adjustable boring-bar here illustrated, which has been placed on the market by R. V. Russell, 1207 Calumet Ave., Middletown, Ohio. The micrometer screw and graduated head on this tool insure accuracy of all settings. Adjustments are quickly made and the setting is positively locked when the tool is in use.

This tool consists of an adjustable head with a shank for attachment to the machine on which the tool is to be used and three interchangeable boring-bars. These bars are 1/2, 3/4, and 1 1/4 inches in diameter for boring to lengths of 4, 5 1/2, and 7 inches, respectively. Shanks of various Brown & Sharpe or Morse tapers can be provided to meet requirements.

In the illustration, the tool is shown equipped with a 1 1/4-inch boring-bar and set for finishing a 12-inch diameter hole, with the tool bit extending only 7/8 inch beyond the bar. This boring tool is applicable to milling machines, drilling machines, lathes, boring machines, etc.



Russell Boring-bar for Holes from 9/16 Inch to 12 Inches in Diameter

## Dial Gage with Jeweled Bearings

The Brown & Sharpe Mfg. Co., Providence, R. I., has brought out a No. 726-A dial gage which is made with jeweled bearings and graduated to 0.0001 inch. This gage is intended for use on the Nos. 731 and 731-A "Super Rigid" tubular-post dial test indicators described in May MACHINERY. It is designed for use when inspection is held to a finer degree of accuracy than is possible with dial gages reading to thousandths of an inch.

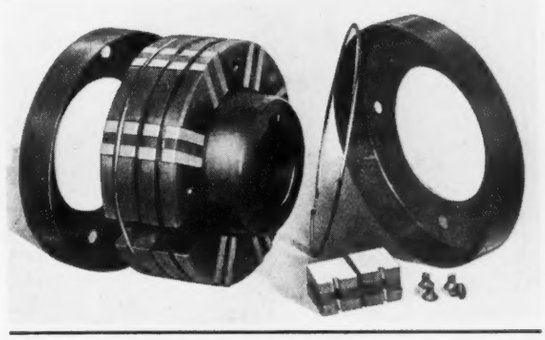
The jeweled bearings insure a smooth, even action and long life. The point of the gage is removable, so that points of different forms and lengths can be employed. The dial face can be turned to bring zero under the index pointer. The gage is regularly furnished with a lug on the back having a 3/16-inch hole in it. The dial is about 2 1/4 inches in diameter and has a spindle movement of 0.020 inch.

## Westinghouse Flexible Couplings

Type WH general-purpose flexible couplings designed for use with Gearmotors, speed reducers, and other industrial drives have recently been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The advantages of these couplings are that they require no lubrication, are easily inspected, and provide for safe operation. They have a cushioning action that protects both the driving and driven equipment against injury from shocks or vibration, and also helps to absorb starting or momentary overloads. These couplings also compensate for slight misalignment.

As may be seen from the illustration, they consist of two identical cast-steel flanged halves, two sheet-steel cover plates, two snap or retaining rings, and from five to twenty-five flexible elements. Machined radially around the periphery of each flange are rectangular slots that receive the cushioning and torsionally flexible elements. The torque transmitting element is a rectangular steel plate, while the cushioning elements are made from hydraulic packing. In assembling, the torque elements are placed in the center of a slot with a cushioning element on each side.

The snap rings are inserted in a groove in the flexible elements and in the coupling flanges. They prevent radial or lateral movement of the flexible elements. These elements can be replaced when required without disturbing either the coupling flanges or the driving or driven equipment.



The Parts that Make Up the Westinghouse Type WH Flexible Coupling

The couplings are machined all over. Being in good balance, they can be used for speeds up to 8000 feet a minute. They are made in a wide range of sizes having ratings from 1.87 to 1870 horsepower per 100 revolutions per minute. The weights range from 6 to over 3100 pounds.

## Blanchard Pulsolator

A Style 3 pumping unit, illustrated in Fig. 1, has been added to the line of Blanchard Pulsolators made by the Lubrication Division of the Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. The principle on which the Pulsolators operate was described in November, 1928, MACHINERY, page 226. With this system, oil can be delivered to as many as 100 bearings at varying rates of feed ranging from three drops of oil an hour to forty drops a minute while the journals are in motion. There is an individual adjustment for each bearing and the oil can be measured visually.

The equipment used in this system consists primarily of the pumping unit, which is built in four styles and nine models having capacities ranging from 3 quarts to 4 gallons. The pumping unit can be driven by a moving member of the machine or an individual motor. The Style 3 unit has a direct-connected motor

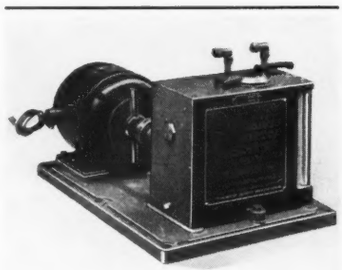


Fig. 1. Blanchard Pulsolator with Direct-connected Motor

mounted on the same base as the pump.

From the pumping unit, a single-loop oil line encircles the machine. On this line are individual feeders for each bearing. A copper drip line connects each bearing with a feeder. The pumping unit circulates a continuous supply of fresh oil through the loop line and the feeders at a minimum pipe-resistance pressure. At definite intervals the pressure is increased within the pipe line, the period of increased pressure being termed a pulsation. Only at the instant of pulsation do the feeders measure out oil to their bearings. Any feed can be adjusted to a rate as slow as one drop in three pulsations or as fast as five drops in one pulsation.

An indicating lever on the pumping unit moves with each pulsation to indicate proper operation of the system. By depressing this lever, the oil pressure can be built up within the loop line to flush the bearings with oil in amounts relative to their individual adjustments. This feature is of particular value in starting up a cold machine. The reservoir of the Style 3 pumping unit houses a standard double-plunger pump which runs in a bath of oil and is, therefore, self-lubricating.

Fig. 2 shows a large Natco drilling and boring machine which is automatically lubricated by two Style 3 Model C pumping units pulsating every fifteen seconds. The loop lines connect 116 feeders, which are arranged in six gangs mounted on stands along the top of the machine in the center section.

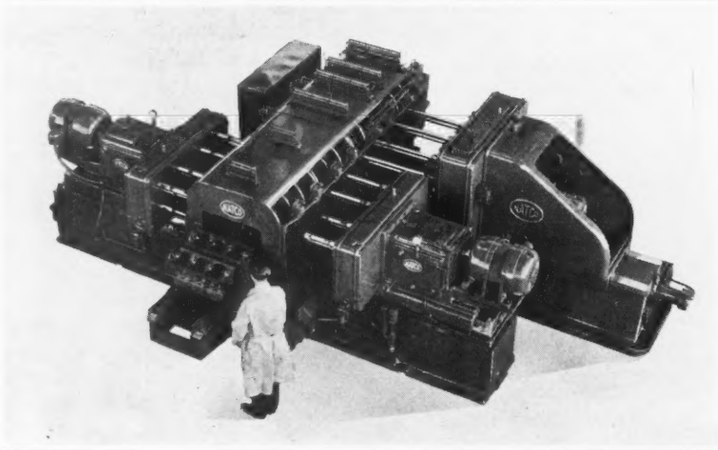


Fig. 2. Natco Drilling and Boring Machine with 116 Bearings Oiled by Two Blanchard Pulsolators

## GE Automatic Arc-Welding Head and Control

Simplicity of design, control, adjustment, and maintenance are features claimed for an improved Type WFA automatic arc-welding head now made by the General Electric Co., 10 Canal St., Schenectady, N. Y. A small motor drives the electrode feed-rolls through worm reduction gearing and a three-speed transmission that provides speeds to suit the size of electrode, current, and rate of metal deposit. A small rheostat is the only adjusting element, which means a quick, accurate control of the electrode feed. All other operations are fully automatic.

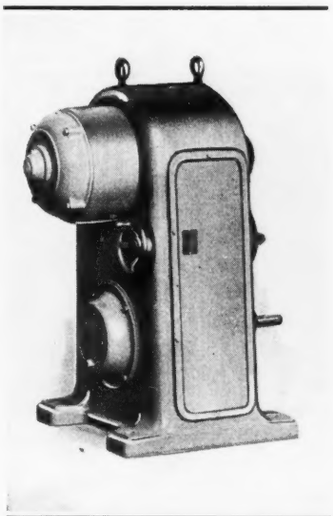
The electric control equipment consists of an enclosed panel on which standard relays and contactors are mounted which actuate, in proper sequence, the required movements for starting, running, and stopping the welding head. There is also an instrument panel that carries meters for measuring the arc voltage and the current, an arc voltage adjusting rheostat, start-stop buttons, a forward-reverse switch for the electrode feed mechanism, and a selector switch

for obtaining either manual or automatic operation of a carriage, when the latter is supplied.

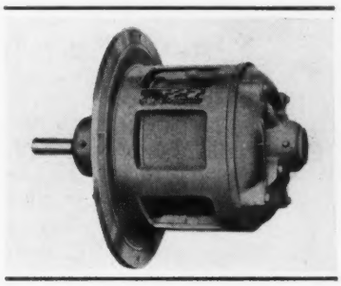
## Sterling Upright Vari-Speed Motors

Variable-speed motor units of a vertical design have been placed on the market by Sterling Electric Motors, Inc., Telegraph Road and Atlantic Blvd., Los Angeles, Calif. These units are made in ratings up to 15 horsepower and come in standard ratios of 2 to 1, 3 to 1, and 4 to 1. However, higher ratios can be provided. The units make possible infinite variations in speed within their ratios.

These upright units are built on the same principle as the horizontal design described in August, 1933, MACHINERY, page 811. A heavy, wide, high-speed V-belt runs on two V-pulleys which are mounted on fixed parallel shafts. By turning a small handwheel, the diameter of both pulleys can be changed simultaneously to obtain the desired speed. The proper tension is automatically maintained on the belt. Either high- or slow-speed gears can be mounted on the output shaft to provide speeds from 5 to 15,000 R.P.M.



Vari-speed Motor Unit of Vertical Design



Flanged-head Motor Made by the Louis Allis Co.

## Flanged-Head Motors

Several types of flanged-head mountings have been developed for the wide line of electric motors manufactured by the Louis Allis Co., Milwaukee, Wis. In the design illustrated, the flange is integral with the motor head and may be finished on either or both sides.

These flanged-head motors are intended for use on lathes, drilling machines, grinders, polishers, and other machines where space limitations or other engineering considerations make it desirable to eliminate motor feet. Motors of the new design can also be used widely on close-coupled pumps.

## Ames Portable Butt Welder

A butt welder of portable design, which was developed primarily to meet the requirements of wire drawing plants so that coils of wire can be made continuously, has been placed on the market by the Ames Spot Welder Co., Inc., 115 Ninth St., Brooklyn, N. Y. This welder can be conveniently moved from machine to machine throughout a plant. It eliminates the need of pointing rods that are to be welded together.

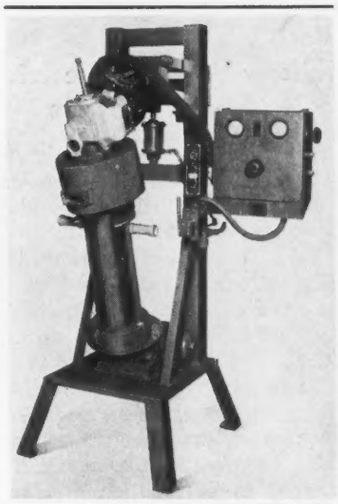
In operation, two clamps are securely gripped on the pieces to be welded and a lever is pulled toward the operator to apply electric current. When sufficient current has been applied, the welding dies are brought into contact with the work pieces by spring pressure. The ends of the two rods then fuse together. As this occurs, a switch operates automatically to shut off the current, and the operation is at an end. With this arrangement, the operator does not control the actual welding.

Annealing dies can be supplied in combination with the welding dies to permit high-carbon steel rods to be annealed after they have been butt-welded together. This machine is made in a number of sizes to accommodate different sizes of material.

## Lincoln Automatic Welders for Automobile Mufflers

Automatic machines for welding automobile muffler assemblies by the shielded-arc process have recently been developed by the Lincoln Electric Co., Cleveland, Ohio. These machines are equipped with Electronic Tornado welding heads, and have a production capacity up to 115 mufflers an hour. Two machines are used for this work, one of them being the vertical machine here shown, and the other a horizontal machine.

The operator places the muffler in position in the welder illustrated, lowers the welding head,



Automatic Machine for Welding Automobile Mufflers

Fig. 1. Portable Electric Drill Made by Skilsaw, Inc.

edge-welds the tubes in place, raises the head, turns the muffler upside down, and finally welds the pipes on the opposite end. The complete operation takes thirty and a half seconds. The second machine lap-welds the muffler tubes for connection to the exhaust pipe.

In one large plant, two men operate four of these automatic welders. On both machines, the welding head remains stationary and the parts are revolved under the arc. This head is of the same type as that employed for many other automatic welding applications. Welding machines can be supplied for various types of mufflers.

## Skilsaw Portable Electric Drills and Blowers

Portable electric drills designed with a view to insuring smooth, dependable performance under heavy-duty conditions are being introduced on the market by Skilsaw, Inc., 3310-20 Elston Ave., Chicago, Ill. These drills, as shown in Fig. 1, are equipped with motors of the universal type designed for operation on direct current or alternating current of 60 cycles or less. The armatures are statically and dynamically balanced to eliminate vibration. The motors are cooled by a balanced fan on the armature shaft. Quick make-and-break switches with an overload capacity of 100 per cent are provided.

The drill bodies are aluminum-alloy die-castings. Spur gears with a special tooth form are employed. The pinions are cut direct on the armature shafts. Chrome-nickel steel shafts are used. Their bearing seats are ground within plus or minus 0.0004 inch. Jacobs chucks are supplied.

The same concern has also recently designed the blower and suction cleaner shown in Fig. 2. This device can be used for cleaning many different types of machines, motors, stock bins, ovens, etc. In addition, it can be easily converted into an insecticide sprayer, paint sprayer, or blow-torch. Five different models are made.

Fig. 2. Blower and Suction Cleaner for a Variety of Uses

## Diamond Stainless-Steel Roller Chains

Roller chains of stainless steel have been made on special order by the Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind., for several years. The demand for stainless steel chains has now increased to such an extent that the company has gone into production on the most commonly used sizes and stocks them for immediate shipment.

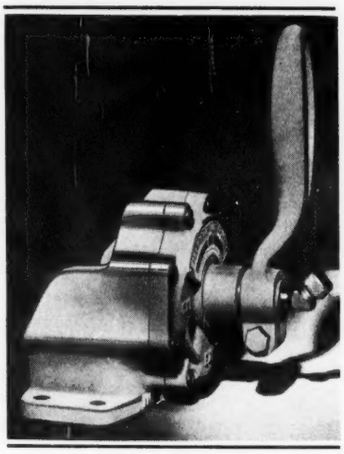
These roller chains are made entirely of 18-8 stainless steel. They are intended for use wherever corrosion is a problem from the standpoint of service life, sanitation, or appearance. Since the chains resist corrosive action of fruit and vegetable juices and do not discolor even when they pass through processed food, they are especially suitable for use in the food industry.

## Hanna Manifold Valve

A manifold valve designed for applications where a number of valves must be located close together has been added to the Unitite line manufactured by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. These valves are suitable for use with air, oil, or water. With the manifold valve, the necessary piping can be provided without interference. The intake and exhaust openings can be conveniently connected to a single supply or exhaust pipe.

Between reversals, the valve disk rotates on two eccentric points while in contact with the seat. Circular lines of contact and scoring do not develop. Both the disk and seat wear uniformly across their full diameter. A balanced disk pressure throughout the contact area is obtained by the arrangement of the seat ports and disk pockets.

The disk is so seated on the valve bonnet that renewals can be made quickly without removing the valve body from the pipe line or disturbing pipe connections and valve mountings.



Hanna Manifold Valve Added to the Unitite Line

Tool-holder that can be Used in Various Machines

## Wells Universal Tool-Holder

A universal tool-holder that can be used in threading, boring, right- or left-hand slotting, keyway cutting, shaping, right- and left-hand turning, and planing operations is a recent product of the Wells Mfg. Co., 6239 King Ave., Bell, Calif. The illustration shows this tool-holder in the position in which it is held for shaping operations. The V-block that supports the tool may be clamped in four positions on the shank.

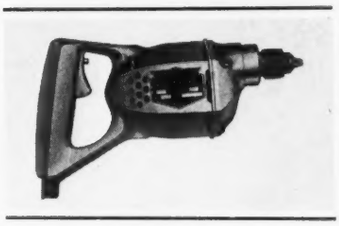
The shank and screws of the tool-holder are made of heat-treated chromium-molybdenum steel; the V-block is made from tool steel and hardened; and both yokes are produced from cold-rolled steel and casehardened. This holder is made in two sizes to accommodate 5/16- and 3/8-inch cutters.

## GE Electrode for Use in Any Position

A general-purpose welding electrode that can be used in any position—that is, for flat, vertical, or overhead welding, has been added to the line of the General Electric Co., 10 Canal St., Schenectady, N. Y. This Type W-22 electrode has deep penetrating properties, and is, therefore, equally suitable for butt and fillet welds. It is of the heavily coated or shielded-arc type and produces welds of the quality required for Class I pressure vessels, in accordance with the A.S.M.E. Boiler Construction Code.

Tests made on specimens of all-weld metal have shown a tensile strength of from 65,000 to 75,000 pounds per square inch and an elongation of from 20 to 30 per cent in 2 inches.

This electrode has a wide field of application in the fabrication of large structures, such as ships and locomotives, where it is impracticable to move the work for welding. It is also particularly adaptable for welding fittings, such as nozzles and flanges, to pressure vessels.



Black & Decker 1/4-inch Streamline Drill

## Black & Decker Sreamline Drill of Smaller Size

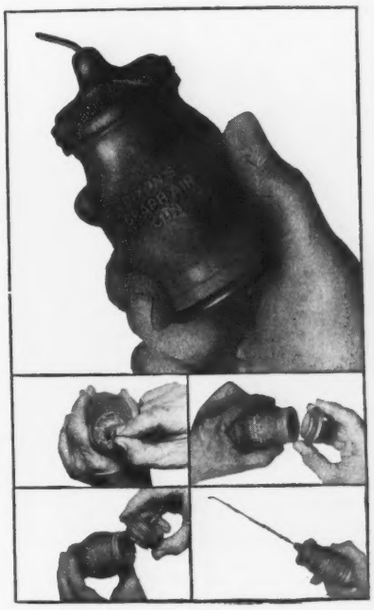
The Black & Decker Mfg. Co., Towson, Md., has brought out a 1/4-inch special electric drill of streamline design as a companion tool to a 1/2-inch streamline drill that was introduced on the market last October. The graceful lines of the new drill are said to aid balance and ease of handling.

Another important feature of the new drill is that the motor power has been increased 33 1/3 per cent over previous models. Anti-friction bearings are used throughout, the armature and chuck spindle being mounted in ball bearings. A switch handle of new design is provided. The drill is driven by a universal motor that is supplied for all voltages. The weight of this tool is 5 3/4 pounds.

## Oilless Temperature- and Combustion-Proof Lubrication

Microfyne flake graphite—a lustrous lubricating powder—and a Graph-Air gun designed for forcing the powder into parts to be lubricated are being placed on the market by the Joseph Dixon Crucible Co., Jersey City, N. J. The gun, which is shown in the accompanying illustration, is made of rubber and is merely squeezed to deliver the desired amount of graphite under a positively controlled air pressure. The amount of graphite forced out is largely regulated by the position of a nozzle relative to a dial. The nozzle can be completely shut off when the gun is not in actual use.

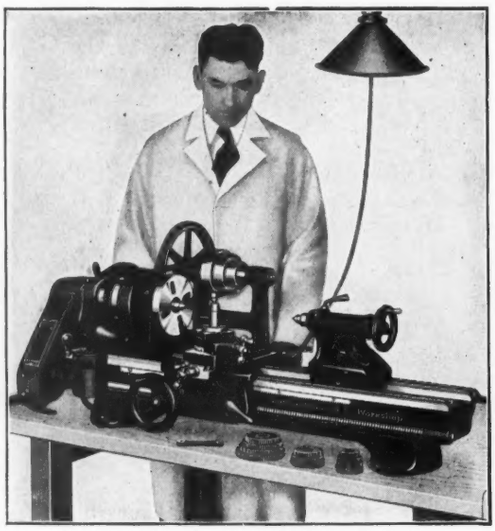
The gun head can be easily unscrewed, as illustrated, when it is desired to refill the device with graphite. A 2-inch nozzle is standard equipment, but an 8-inch nozzle can be supplied. The graphite can be used alone to provide oilless, greaseless, temperature-proof and combustion-proof lubrication, or it can be employed as a co-lubricant with plain oil or grease in several different ways.



Graph-Air Gun Designed to Use Microfyne Flake Graphite

## South Bend Work-Shop Bench Lathe

A low-priced back-geared screw-cutting lathe of 9-inch swing, available with either a countershaft drive or a motor drive, has been placed on the market by the South Bend Lathe Works, 426 E. Madison St., South Bend, Ind., under the name of "No. 5 Work-shop" lathe. The design of this lathe and of its controls is so simplified that it can be operated by the novice as well as by experienced machinists and lathe hands.

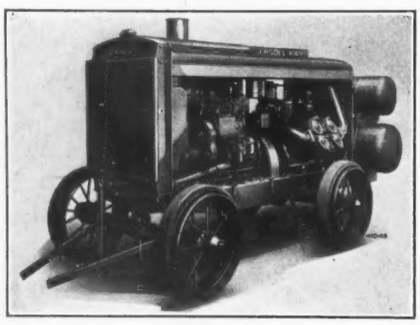


South Bend Work-shop Lathe of 9-inch Swing

All fundamental lathe operations can be performed, including the cutting of screw threads, right- or left-hand, from 4 to 40 per inch. The mechanical features of the machine include a six-speed back-geared headstock, a hollow headstock spindle for handling both bar and chuck work, an automatic power feed to the carriage, a graduated compound rest that swivels to any angle, a tailstock with a set-over for taper turning, and a nickel-iron bed having three V-ways and one flat way.

## Portable Air Compressors Driven by Oil Engines

Two-stage, air-cooled, portable air compressors are now made in six sizes with either an oil-engine drive or a gasoline-engine drive by the Ingersoll-Rand Co., 11 Broadway, New York City. A compressor with an oil-engine drive is shown in the illustration. The engine is a four-cycle solid-fuel-injection spark-ignition type that combines the advantages of both gasoline and Diesel engines. One of the principal advantages is a saving in fuel cost resulting from the use of inexpensive non-explosive fuel oils, such as household furnace oil.

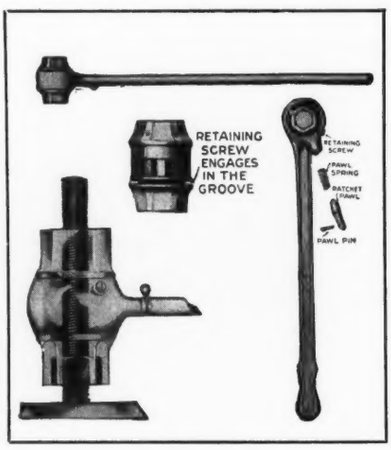


Oil-Engine Driven Two-stage Portable Air Compressor

## Stronger Reversible Ratchet Wrenches

Greater strength has been obtained in a new model of the "Favorite" reversible ratchet wrenches manufactured by Greene, Tweed & Co., 109 Duane St., New York City, by the use of a new metal for the handles, heads, and pawls. In addition, the handles and heads have been regrouped to avoid awkward combinations and duplications that existed in the past. To accomplish this change, it was necessary to make new metal patterns, and these insure a more accurate fit of the nut in the head.

These wrenches are now made with a cadmium finish which has improved the appearance and gives greater protection against corrosion. One of the features of the design is that an opening in the head allows a bolt to pass clear through the wrench. In using these wrenches, the head is not removed from the nut until the tightening or loosening has been completed.




Reversible Ratchet Wrench Made of a New Metal

* * *

## Moisture-Proof Factory Walls

Driving rain will frequently seep through building walls, causing considerable damage. For years, industry has sought a practical and economical way of treating walls to make them impervious to penetration by driving rain. A liquid known as "Stonhard Stonhide" has now been brought out by the Stonhard Co., Philadelphia, Pa., which can be simply brushed or sprayed over the wall to waterproof it. The material is transparent and can be applied without discoloring the surface treated. It is used particularly on brick, concrete, and stucco walls, but can be used on frame buildings as well.